RFID-BASED ATTENDANCE SYSTEM WITH REMOTE MONITORING

MUHAMMAD SAZALI BIN HISHAM

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MUHAMMAD SAZALI BIN HISHAM

A thesis submitted in fulfillment of the
requirements for the award of the degree of
Bachelor of Engineering (Electrical - Computer)

Faculty of Electrical Engineering
Universiti Teknologi Malaysia

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Dedicated to my beloved father, mother, sisters and brother, and not forgetting my friends.

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ABSTRACT

Radio Frequency Identification (RFID) technology has been widely used by various industries as a part of an automation system. In this study, an RFID based system has been built in order to produce more efficient time-attendance management system. This system consists of 3 main parts which is an RFID reader, a host computer and a remote computer. The RFID reader, which is a low-frequency reader (125 kHz), connected to the host computer either to via serial port or USB port. The host computer prototype was built using Intel Desktop Board D401PT which has an integrated Intel Atom processor and run Windows operating system. There were two graphical user interfaces (GUI) developed in which are the Time-Attendance System and the Remote Monitoring Client. These GUIs were developed via Microsoft Visual Studio using C#.Net language. The Time-Attendance Management System provides the functionalities of the overall system such as displaying live ID tags transactions, registering ID, deleting ID, recording attendance and the other minor functions. This interface was installed in the host computer. In contrast, the Monitoring Client was installed in the remote computer where remote monitoring can be executed using Remote Desktop Protocol technology. The host computer and the remote computer were connected using Local Area Network (LAN).This management system provides convenient and efficient attendance recording plus saving user's energy. It is suitable for indoor use as an office solution or the class attendance system for academic institutes.

ABSTRAK

Teknologi RFID telah digunakan secara meluas dalam pelbagai industri sebagai sebahagian daripada sistem automatik yang digunakan. Dalam projek ini, sebuah sistem kehadiran menggunakan teknologi RFID telah dibina. Sistem ini terbahagi kepada tiga komponen utama iaitu pengimbas RFID, komputer hos dan komputer remote. Pengimbas RFID yang digunakan ialah pengimbas pada frekuensi rendah (125 kHz) dan disambung ke komputer hos melalui port sesiri atau port USB. Prototaip bagi komputer hos dibina menggunakan Intel Desktop Board D410PT yang mengintegrasikan pemproses Intel Atom. Komputer ini beroperasi menggunakan sistem pengoperasian Window. Terdapat dua GUI yang dibina iaitu Time Attendance dan juga Remote Monitoring Client. GUI ini dibina di dalam Microsoft Visual Studio dengan menggunakan bahasa aturcara C#.Net. Fungsi-fungsi utama keseluruhan sistem ini terdapat di dalam Time Attendance seperti memaparkan transaksi tag ID secara langsung, mendaftar ID, memadam ID, merekod kehadiran dan diikuti fungsi-fungsi sampingan yang lain. Perisian Time Attendance ini disimpan di dalam komputer hos. Pengawasian jarak jauh boleh dilakukan menggunakan perisian Remote Monitoring Client yang disimpan di dalam komputer remote. Remote Monitoring Client ini dibina berdasarkan teknologi Remote Desktop Protocol. Komputer hos dan komputer remote berhubung melalui rangkaian dalaman (LAN). Sistem ini memudahkan pengrekodan kehadiran dan ia dilakukan secara efisyen. Selain itu ia menjimatkan tenaga pengguna. Sistem ini sesuai untuk kegunaan dalaman seperti di dalam pejabat ataupun di dalam kelas di institusi pengajian.

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LIST OF ABBREVIATIONS

RF	-	Radio Frequency
ID	-	Identification
RFID	-	Radio Frequency Identification
GUI	-	Graphical User Interface
LAN	-	Local Area Network
USB	-	Universal Serial Bus
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
LF	-	Low Frequency
HF	-	High Frequency
UHF	-	Ultra High Frequency
LED	-	Light Emitting Diode
UART	-	Universal Asynchronous Receiver Transmitter
RS-232	-	Recommended Standard 232
RDP	-	Remote Desktop Protocol
TCP	-	Transmission Control Protocol
IIS	-	Internet Information Service

RAM	-	Random Access Memory
IP	-	Internet Protocol
LCD	-	Liquid Crystal Display
HTTP	-	Hypertext Transfer Protocol
HTTPS	-	Hypertext Transfer Protocol Secure
FTP	-	File Transfer Protocol
FTPS	-	File Transfer Protocol Secure
SMTP	-	Simple Mail Transfer Protocol
NNTP	-	Network News Transfer Protocol
DAO	-	Data Access Object
VBA	-	Visual Basic for Application
SQL	-	Structured Query Language

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CHAPTER 1

INTRODUCTION

1.1 Background of Project

In this modern world, there still workplaces or academic institutions that still using traditional way of taking attendance. For example, attendance sheet method where attendees need to pass around the sheet to sign it as the proof of attending the session. There is also “punch card” method which is usually used by factories to mark the attendance of its workers. Workers need to slot their attendance card into the punch card machine and put the card into a shell-like slot where the authority can review it.

As technology has advanced, integrating the attendance system with an automation technology will provides more convenient way in marking the attendance. The Radio Frequency Identification (RFID) technology is one of an automation technology that is beneficial in improving current traditional way of attendance marking. As every tag has its own unique ID, it is easy to differentiate every tag holder.

In addition, a Graphical User Interface (GUI) provides more efficient way to review the attendance. Thus, the integration of RFID technology and the GUI in an attendance system will produces an automatic system which give better performance and efficiency than the traditional method of attendance marking.

1.2 Problem Statement

The traditional method of attendance marking has some drawbacks. This method obviously not efficient as it wastes the user's energy and quite slow in term of completion. For example, a class that uses attendance sheet method requires the students to pass the sheet to each other to sign up the attendance. If there is a large amount of students, it will take time in order to complete the attendance marking. Besides that, there is possibility that some students might miss their turn to sign the attendance as they did not receive the attendance sheet.

It is same goes to the "punch card" system. Workers has to queue up for a long time as each worker need to punch the card and then put it in the slot provided according to their names. In summary, both system give drawback in term of performance.

In term of organizing the attendance, there is also a possibility where the attendance sheet might be lost and this will cause difficulty to review the attendance. Furthermore, usually there is no copy of the record. As a result, this will produce an inaccurate overall attendance counting.

1.3 Objectives of Project

The main objective in this project is to provide a convenient way of attendance marking using the RFID technology. In specific, the objectives are:

I. To build an attendance system that consists of a GUI with the integration of the RFID technology.

II. To enable the attendance system to be monitored remotely.

1.4 Scope of Project

This project is mainly focused on GUI development. There are two parts of GUI to be developed which is the Time Attendance and the Remote Monitoring Client. A database also been built to store the data.

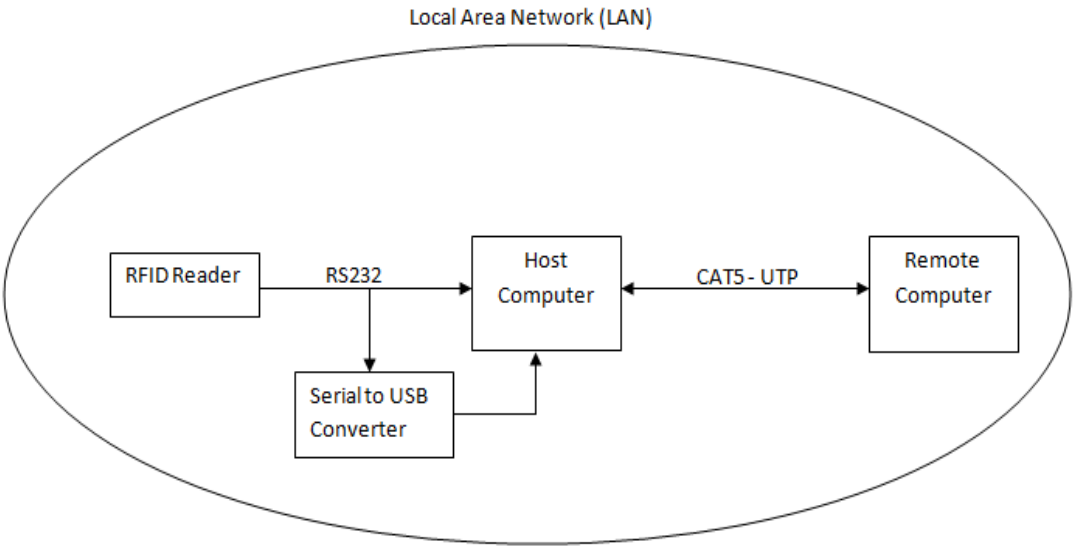

Figure 1.1: System Block Diagram

Figure 1.1 shows the block diagram of the system. The RFID reader is connected to the host computer via serial port or USB port. The RFID reader is using RS232 data communication thus a serial to USB converter is required if connection to the USB port of the host computer is chosen. The Time Attendance GUI is stored in the host computer with the database while the Remote Client GUI is stored in the remote computer. The remote computer access the host computer via internetwork within Local Area Network (LAN).

1.5 Work Contribution

RFID-based Attendance System which is able to be monitored remotely is successfully developed. The main contributions of this project are:

- Manage to develop the Time Attendance GUI that capable to track absentees, count overall absentees and provide lives transaction.
- Manage to develop the Remote Monitoring Client GUI that enable user to monitor the live transaction besides manipulating data.
- Manage to integrate the GUI with the database to access data stored.
- Successfully tested the system.

The details of works involved in developing RFID Based Attendance System is shown in **Figure 1.2** and **Figure 1.3**

Week/ Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Finding project title																
Discussion on project title																
Information findings																
Submit project proposal																
Literature Review																
Learning C# Language																
Presentation																
Report Writing																

Figure 1.2: Gantt chart of the project schedule for Semester 1

Week/Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Developing Remote Client GUI																		
Work on receiving serial data from the interface																		
Work on interfacing database																		
Developing Time Attendance GUI																		
Debugging																		
Hardware Installation and Final Check																		
Presentation																		
Thesis Writing																		

Figure 1.3: Gantt chart of the project schedule for Semester

CHAPTER 2

LITERATURE REVIEW

2.1 Radio Frequency Identification (RFID)

Radio frequency identification (RFID) is a kind of automatic identification technology which uses radio waves as the medium to store or retrieve data stored in a device called RFID tags or transponders. The tags can be applied on animals, product or a person for the purpose of identification. The distance for the tags to be read by the reader is varied based on the frequency of the radio wave.

A typical RFID system consists of antenna, transponder and transceiver. The antenna is used by both transponder and transceiver to transmit the radio waves. The transceiver reads the radio wave emitted by the transponder and transfers the signal to the processing device. A transponder is an integrated circuit that contains information to be transmitted.

As this technology is using radio frequency signal, that's mean it works wireless. Generally the reader emits radio wave via an antenna with specified frequency which is the carrier signal. When the tags detected the signal from the reader, it transmits a modulating signal which contains the information that has been stored in its integrated circuit and signal modulation occurs. The antenna of the reader then receives the modulated signal and feeds it through signal processing circuit of the reader to translate the information.

2.1.1 RFID tags

There are three types of RFID tags; passive, active and semi-passive. The passive RFID tag requires no internal power source as it gains power from the signal transmitted by the reader. Thus, it becomes purely passive. The active and semi-passive tag requires a power source. Commonly the power source is a small battery. These tags communicate using backscattering or load modulation technique. Typically load modulation technique used for short distance reading while the backscattering is used for far field.

2.1.1.1 Passive RFID tag

The passive RFID tag does not contain a battery. The power is supplied by the RFID reader. When the tag encounters the radio wave emitted by the reader, the coiled antenna inside the tag forms a magnetic field thus current induced. The tag draws power from it and energizes the circuit in the tag. As a result, the tag transmit signal that contain the information of its memory which received by the signal detector of the reader to be processed. This type of tag can be read at only short distance (typically a few feet at most) thus it is more suitable for short distance reading application such as door access and office solution. Typically this tag has a useful life of twenty years or more and less expensive. The response of a passive RFID tag is not necessarily just an ID number; the tag chip can contain non-volatile, possibly writable EEPROM for storing data.

2.1.1.2 Active RFID tag

Active tag is equipped with a battery as the source of power to the tag's circuitry and antenna. Some active tag contains replaceable battery for years to use. It is also possible to use external power supply as the power source of the tag. As active tag cannot function without a battery, it has limited lifetime. Active tag can be read from a long distance of hundred feet or more and may have other sensors that can use electricity for power. It capable to initiate communication and has higher data bandwidth.

2.1.2 RFID Frequency Band

Frequency refers to the size of the radio waves used to communicate between the RFID system's components. It can be assumed that higher frequency resulting faster data transfer rate and longer reading distance. However as frequency increases, the sensitivity to environmental factor also increases. RFID system currently operates at Low Frequency (LF), High Frequency (HF) and Ultra High Frequency (UHF). Generally a lower frequency means a lower read range and slower data read rate, but increased capabilities for reading near or on metal or liquid surfaces [1]. The frequency chart is shown in **Table 2.1**

Frequency Band	Description	Operating Range	Application	Benefit	Drawback
125 kHz to 134 kHz	Low frequency	< .5 m or 1.5 ft.	• Access Control • Animal Tracking • Vehicle Immobilizers • Product Authentication • POS Application	Works well around water and metal product.	Short read range and slower read rate.
13.56 MHz	High frequency	<1m or 3 ft.	• Smart cards • Smart shelve tag for item level tracking • Library books • Airline baggage • Maintenance data logging	Low cost of tags	Higher read rate than LF
860 MHz to 930 MHz	Ultra High Frequency (UHF)	3 m or 9ft.	• Pallet tracking • Carton tracking • Electronic toll collection • Parking lot access	EPC standard built around this frequency	Does not work well with high water or metal content.
2.4 GHz	Microwave	1m or 3ft.	• Airline baggage • Electronic toll collection	Most expensive	Fastest read rates

Table 2.1: RFID Frequency Chart

2.1.3 IDR-232 RFID Reader

Figure 2.1: IDR-232 RFID Reader

Description and specifications:

- 9600 baud RS232 serial interface (output only) to PC.
- Fully operation with 5VDC power supply from USB port.
- Red and green color LED for visual indication of activity.
- Standard RS232 serial cable (female) ready to plug to desktop PC.
- USB as power source from desktop PC.
- 2cm reading range.
- 0.1s response time.
- 14 bytes of data received include start of text, RFID ID, carriage return, new line, and end of text.
- Frequency band used : 125 kHz (Low Frequency)

2.2 Serial Data Transmission

Serial data transmission is widely for transmission of digital data. Serial transmission means data is sent one bit after another sequentially (bit-serial) in one transmission line. It is also possible to have high data rate through this transmission as the increased time consumption required using this type of transmission is acceptable for most cases. **Figure 2.2** shows the simple 2-wire for bit-serial data transmission.

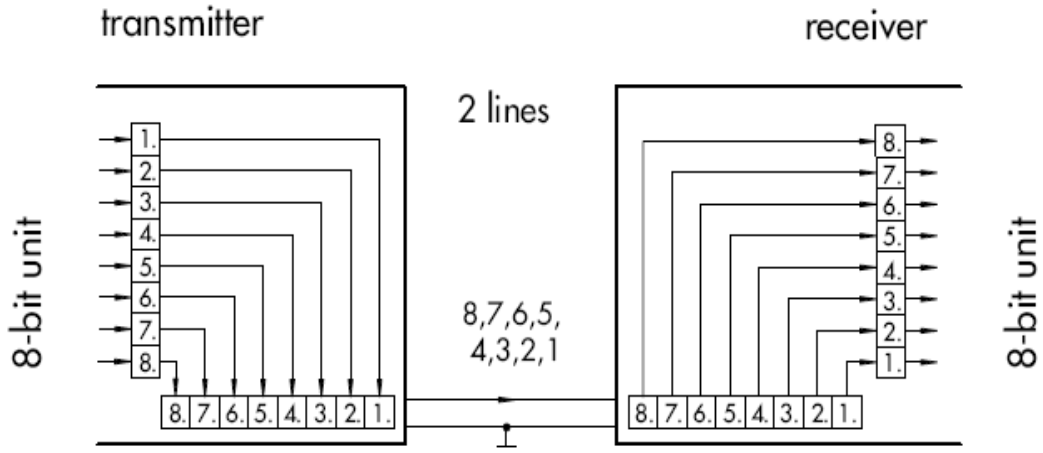

Figure 2.2: Serial Data Transmission

There are three types of data flow direction which are simplex, half duplex and full duplex. For simplex, data direction is only in one flow. In the other words, it can only transmit or receives data. Half duplex direction means the stations have to take turns to transmit data. It shares a line to transmit their data so the data transmission for both stations cannot be at the same time. The other type is full duplex which data from both stations can exchanges data simultaneously. The illustration of the direction of serial data flow can be seen in **Figure 2.3**

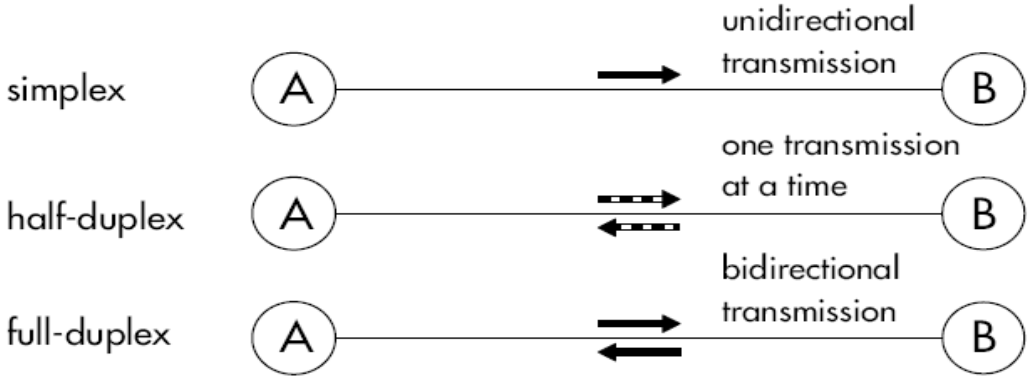

Figure 2.3: Different Direction of Serial Data Flow

2.2.1 RS-232 Interface

RS-232 Interface (Recommended Standard 232) is a standard defines by Electronic Industries Association (EIA) for serial data transmission. This standard uses asynchronous data transmission where a word consists of a start bit, seven or eight data bits, optional one parity bit and one or two stop bits. The transmission can be executed minimally using three wires: send data, receive data and signal ground. The minimum recognized voltage of this standard is 3V. It specifies that logic "1" has been sent when the voltage is -3V to -15V while logic "0" when the voltage is 3V to 15V. Typically the speed of the transmission measured in baud rate which is 150 times an integer power of 2, ranging from 0 to 7 (150, 300, 600 ,...., 19,200). The standard has not defines the maximum cable length but the maximum capacitance that a compliant drive circuit must tolerate. A widely-used rule-of-thumb indicates that cables more than 50 feet (15 meters) long will have too much capacitance, unless special cables are used. The most common connector used for modern computer is DB-9 type.

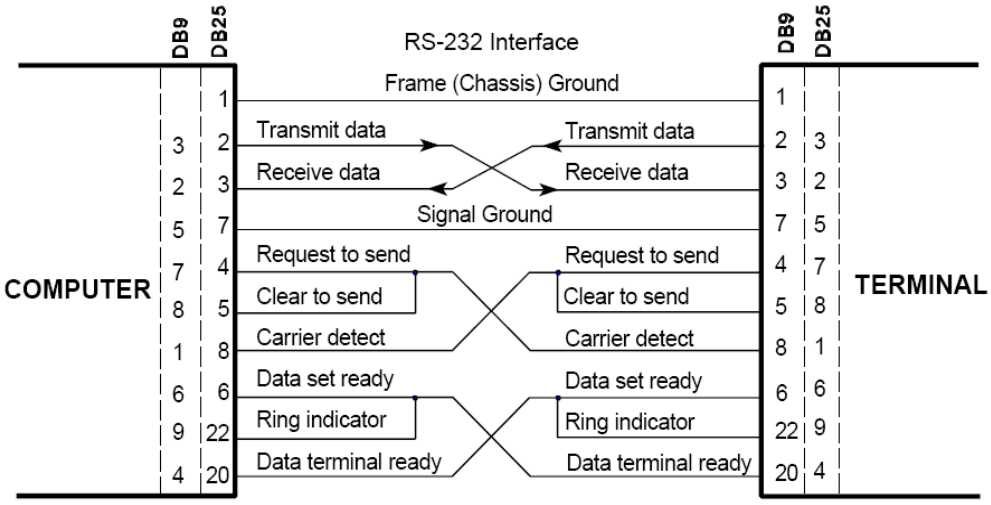

Figure 2.4: Direct-to-Computer RS-232 Interface

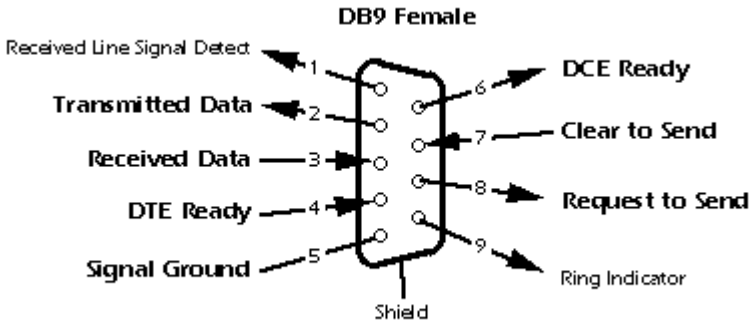

Figure 2.5: Pin Description of DB-9 Female Connector

2.2.2 UART

Universal Asynchronous Receiver Transmitter (UART) is a component used to convert between parallel data transmission and serial data transmission. Thus UART is essential especially for asynchronous serial data transmission. As microprocessor uses parallel data transmission, it has to be converted into serial data stream before it fed into serial data line. UART convert byte into serial bit data or a group of serial bit data into byte.

When two or more devices communicate with each other using asynchronous communication, and the devices operate at independent clock, it requires synchronization bits to maintain the integrity of the signal. This is because there is no guarantee that the clocks of the communicating devices have exactly same frequency and phase for an extended period. Because of that, UART is required to provide the synchronization bits. The simplified UART architecture is shown in **Figure 2.6**

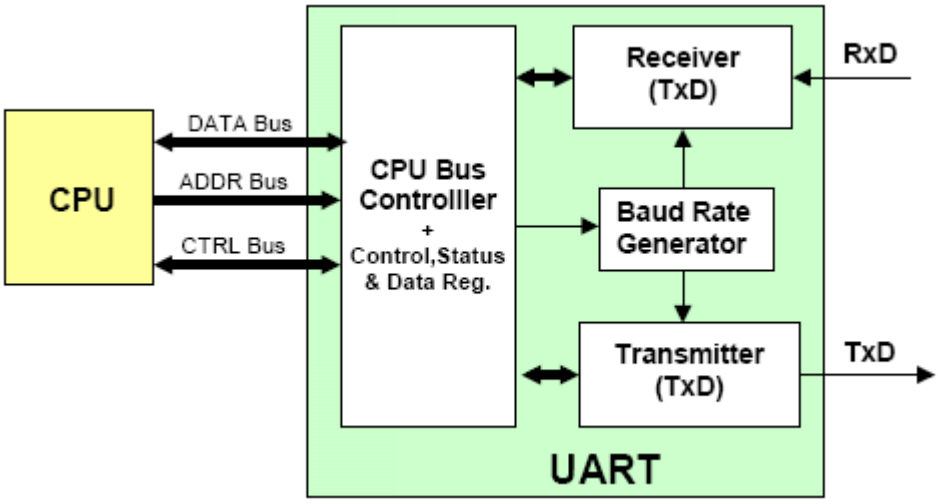

Figure 2.6: UART Architecture

CPU Bus Controller provides the parallel data I/O interface to the local processor bus. It generates the control signal to enable the CPU to have the access onto the data, status and control register in the UART circuit .The Baud Rate Generator generates a periodic pulse which determines the baud rate of the transmission. This transmit and receive bit timing device is programmable so the baud rate can be set according the programming value. The transmitter is responsible for serial transmitting of the data which is written by the CPU onto the TxD Hold Register (or FIFO) at the CPU Bus Controller block while the receiver block detects the start bit of the incoming serial data and sample the data, bit by bit according to the baud clock of the baud rate generator. It complete the receive process of a symbol (6, 7 or 8 bit of data) after detecting the stop bits. It also executes parity check to ensure the correctness of the frame of data.

2.3 Universal Serial Bus

Universal Serial Bus **(USB)** is a bus system which allows more than one peripheral to be connected to a host computer via one **USB** port. Hubs can be used in the USB chain to extend the cable length and allow for even more devices to connect to the same USB port. The standard not only describes the physical properties of the interface, but also the protocols to be used. Because of the complex **USB** protocol requirements, communication with **USB** ports on a computer is always performed via a device driver. When the host powers up, it queries all of the devices connected to the bus and assigns each one an address. This process is called enumeration**.** Devices are also enumerated when they connect to the bus. The host also finds out from each device what type of data transfer it wishes to perform:

- Interrupt - A device like a mouse or a keyboard, which will be sending very little data, would choose the interrupt mode.

- Bul**k** - A device like a printer, which receives data in one big packet, uses the bulk transfer mode. A block of data is sent to the printer (in 64-byte chunks) and verified to make sure it's correct.
- Isochronous - A streaming device (such as speakers) uses the isochronous mode. Data streams between the device and the host in real-time, and there is no error correction.

The host can also send commands or query parameters with control packets. As devices are enumerated, the host is keeping track of the total bandwidth that all of the isochronous and interrupt devices are requesting. They can consume up to 90 percent of the 480 Mbps of bandwidth that's available (USB 3.0 increases that speed to 4.8 gigabits per second). After 90 percent is used up, the host denies access to any other isochronous or interrupt devices. Control packets and packets for bulk transfers use any bandwidth left over (at least 10 percent).

The Universal Serial Bus divides the available bandwidth into frames, and the host controls the frames. Frames contain 1,500 bytes, and a new frame starts every millisecond. During a frame, isochronous and interrupt devices get a slot so they're guaranteed the bandwidth they need. Bulk and control transfers use whatever space is left. The technical links at the end of the article contain lots of detail if you'd like to learn more.

2.3.1 USB to Serial Converter

Defining RS232 communications and ports are often almost directly accessed in the application program. Settings like baud rate, data bits, and hardware software flow control can often be changed within the application. In contrast, the USB interface does not give this flexibility. However, when an RS232 port is used via an USB to RS232

converter, this flexibility should be present in some way. Therefore to use an RS232 port via an USB port, a second device driver is necessary which emulates a RS232 UART, but communicates via USB**.**

RS232 ports which are physically mounted in a computer are often powered by three power sources: +5 Volts for the UART logic, and -12 Volts and +12 Volts for the output drivers. USB however only provides a +5 Volt power source. Some USB to RS232 converters use integrated DC/DC converters to create the appropriate voltage levels for the RS232 signals, but in very cheap implementations, the +5 Volt voltages is directly used to drive the output.

2.4 Microsoft Visual Studio

Microsoft Visual Studio is an Integrated Development Environment from Microsoft. It can be uses to develop console and graphical user interface application along with Windows Forms applications, web sites, web applications, and web services in both native code together with managed code for all platforms supported by Microsoft Windows, Windows Mobile, Windows CE, .NET Framework, .NET Compact Framework and Microsoft Silverlight. Visual Studio includes a code editor supporting IntelliSense as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other built-in tools include a forms designer for building GUI applications, web designer, class designer, and database schema designer. Visual Studio supports different programming languages by means of language services, which allow the code editor and debugger to support (to varying degrees) nearly any programming language, provided a language-specific service exists. Built-in languages include C/C++ (via Visual C++), VB.NET (via Visual Basic .NET), C# (via Visual C#), and F# (as of Visual Studio 2010). Support for other languages such as M, Python, and Ruby among others is available via language services installed

separately. It also supports XML/XSLT, HTML/XHTML, JavaScript and CSS. Individual language-specific versions of Visual Studio also exist which provide more limited language services to the user: Microsoft Visual Basic, Visual J#, Visual C#, and Visual C++.

2.5 Microsoft .NET Framework

The Microsoft .NET Framework is a software framework that can be installed on computers running Microsoft Windows operating systems. It includes a large library of coded solutions to common programming problems and a common language infrastructure that manages the execution of programs written specifically for the framework. The .NET Framework supports multiple programming languages in a manner that allows language interoperability, whereby each language can utilize code written in other languages; in particular, the .NET library is available to all the programming languages that .NET encompasses.

The framework's Base Class Library provides a large range of features including user interface, data access, database connectivity, cryptography, web application development, numeric algorithms, and network communications. The class library is used by programmers, who combine it with their own code to produce applications.

Programs written for the .NET Framework execute in a software environment that manages the program's runtime requirements. Also part of the .NET Framework, this runtime environment is known as the Common Language Runtime (CLR). The CLR provides the appearance of an application virtual machine so that programmers need not consider the capabilities of the specific CPU that will execute the program. The CLR also provides other important services such as security, memory management, and exception handling. The class library and the CLR together constitute the .NET Framework.

2.6 C# Programming Language

C# is a multi-paradigm programming language encompassing imperative, declarative, functional, generic, object-oriented (class-based), and component-oriented programming disciplines. It was developed by Microsoft within the .NET initiative and later approved as a standard by ECMA (ECMA-334) and ISO (ISO/IEC 23270). C# is one of the programming languages designed for the Common Language Infrastructure. The goals of this programming language design are:

- C# language is intended to be a simple, modern, general-purpose, object-oriented programming language.
- The language, and implementations thereof, should provide support for software engineering principles such as strong type checking, array bounds checking, detection of attempts to use uninitialized variables, and automatic garbage collection. Software robustness, durability, and programmer productivity are important.
- The language is intended for use in developing software components suitable for deployment in distributed environments.
- Source code portability is very important, as is programmer portability, especially for those programmers already familiar with C and C++.
- Support for internationalization is very important.
- C# is intended to be suitable for writing applications for both hosted and embedded systems, ranging from the very large that use sophisticated operating systems, down to the very small having dedicated functions.
- Although C# applications are intended to be economical with regard to memory and processing power requirements, the language was not intended to compete directly on performance and size with C or assembly language.

2.7 Microsoft Office Access

Microsoft Office Access, previously known as Microsoft Access, is a pseudo-relational database management system from Microsoft that combines the relational Microsoft Jet Database Engine with a graphical user interface and software-development tools. It is a member of the Microsoft Office suite of applications, included in the Professional and higher editions or sold separately. In mid-May 2010, the current version Microsoft Office Access 2010 was released by Microsoft in Office 2010; Microsoft Access 2007 was the prior version. Access stores data in its own format based on the Access Jet Database Engine. It can also import or link directly to data stored in other applications and databases.

Software developers and data architects can use Microsoft Access to develop application software, and "power users" can use it to build simple applications. Like other Office applications, Access is supported by Visual Basic for Applications, an object-oriented programming language that can reference a variety of objects including DAO (Data Access Objects), ActiveX Data Objects, and many other ActiveX components. Visual objects used in forms and reports expose their methods and properties in the VBA programming environment, and VBA code modules may declare and call Windows operating-system functions.

2.8 Remote Desktop Protocol

Remote Desktop Protocol (RDP) is a protocol developed by Microsoft where it enables a computer to have the graphical interface of another user. The clients exist for most versions of Microsoft Windows (including Windows Mobile), Linux, Unix, Mac OS X and other modern operating systems. By default the server listens on Transmission Control Protocol (TCP) port 3389. The TCP provide the service of exchanging data between to network hosts.

In order to enable the protocol, the host computer makes a connection to Windows Terminal Server and the client computer get the access of the host from the terminal. Thus, only keyboard, mouse, and display information are transmitted over the network as all applications are hosted on the Terminal Server. As a result it works well even under low-bandwidth conditions[2]. The system flow diagram of RDP is shown in **Figure 2.7**

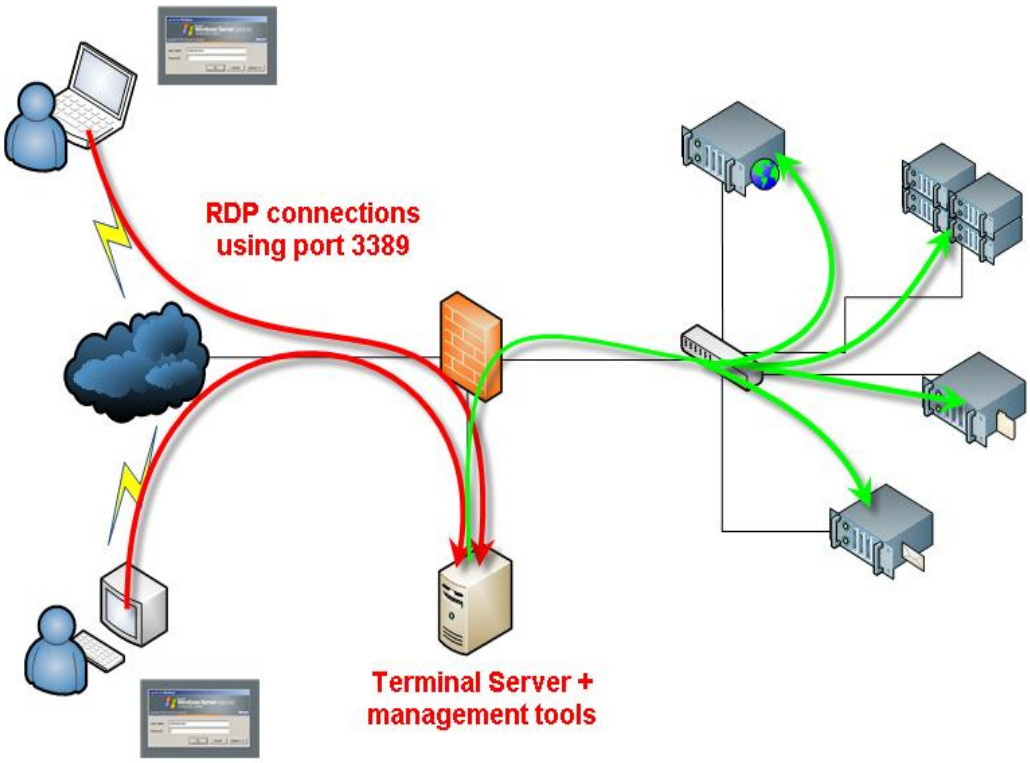

Figure 2.7: System Flow Diagram of RDP

2.9 Internet Information Service (IIS)

Internet Information Services (IIS) is a web server application and set of feature extension modules created by Microsoft for use with Microsoft Windows. It is the second most used web server behind Apache HTTP Server. The protocols supported in latest IIS, IIS 7.5 include: FTP, FTPS, SMTP, NNTP, and HTTP/HTTPS. There are some modules featured in IIS which are:

- HTTP modules – Used to perform tasks specific to HTTP in the request-processing pipeline, such as responding to information and inquiries sent in client headers, returning HTTP errors, and redirecting requests.

- Security modules – Used to perform tasks related to security in the request-processing pipeline, such as specifying authentication schemes, performing URL authorization, and filtering requests.

- Content modules – Used to perform tasks related to content in the request-processing pipeline, such as processing requests for static files, returning a default page when a client does not specify a resource in a request, and listing the contents of a directory.

- Compression modules – Used to perform tasks related to compression in the request-processing pipeline, such as compressing responses, applying Gzip compression transfer coding to responses, and performing pre-compression of static content.

- Caching modules – Used to perform tasks related to caching in the request-processing pipeline, such as storing processed information in memory on the server and using cached content in subsequent requests for the same resource.

- Diagnostics modules – Used to perform tasks related to logging and diagnostics in the request-processing pipeline, such as passing information and processing status to HTTP.sys for logging, reporting events, and tracking requests currently executing in worker processes.

CHAPTER 3

METHODOLOGY

In order to implement the RFID-Based Attendance System with monitoring capability, an RFID reader, a host computer and a remote computer are required. There are two software to be developed which are the Time Attendance that to be stored in the host computer and the Remote Monitoring Client that to be stored in the remote computer.

3.1 Hardware Implementation

The hardware required to complete the system are the RFID reader with its tag, a host computer, a remote computer which is any available computer and a USB to serial converter. However, there is no hardware to be developed as all the hardware required are plug and play type and this project is more focused on developing the software.

3.1.1 RFID Reader

The RFID reader used in this project is called IDN-232 RFID Reader. This RFID reader uses low frequency band, which is 125 kHz. Practically, the reading distance between the tag and the reader is about 2 cm. The output of this reader is transmitted serially. It also transmitted data at 9600 baud rates.

Figure 3.1: IDR-232 RFID Reader

The reason that this reader has been chosen is because it has a DB9 female header, which can be used to connect to the serial port of personal computer. The IDN-232 RFID Reader also provides a simple way to check its functionality. It can display the unique ID of the tag through the HyperTerminal application in Window operating system.

3.1.2 RFID Tags

Figure 3.2: RFID Tags

Figure 3.2 shows the RFID tags used in this project. These RFID tags are passive tags thus it has no internal power supply. These tags activated by radio frequency transmitted by the reader. The reading distance is about 3 cm. When the RFID reader receives the data from the tag, the data then will be compared with the data in the database to identify the holder of the tag.

3.1.3 Host Computer

In order to test and demonstrate the full system functionality, a prototype host computer has been built. Intel D410PT Desktop Board has been selected as the motherboard because of its mini-ITX size and it also has on board Intel Atom 1GHz speed processor in a reasonable price. A 1GB DDR2 RAM is used to run this computer and an 80GB SATA hard disk as the storage. A Cooler Master CPU Fan also been used to enhance the cooling process. To power up the computer, a 300W ATX power supply is used.

Figure 3.3: Host Computer Prototype

3.1.4 USB to Serial Converter

A USB to Serial Computer is used in order to provide versatility to this system. With the help of this converter, the RFID reader can be connected whether to the serial port or to the USB port of the host computer. The converter has its own driver provided which has to be installed in the host computer. The host computer will treats the data similarly to the serial port connection but using different COM port.

Figure 3.4: USB to Serial Converter

3.2 Software Implementation

There are two interfaces that to be developed which are the Time Attendance and the Remote Monitoring Client. These interfaces are developed using C# programming language via Microsoft Visual Studio 2008. In the other hand, the databases are built using Microsoft Access 2007.

3.2.1 Microsoft Access Database

There are two databases are built using Microsoft Access 2007. The databases named “LoginDB” and “TADB”. The “LoginDB” database stores login information for Time Attendance interface. This information also used in admin identification for manipulating attendance information. In the other hand, the “TADB” database stores all attendance- related data. The password data is saved in password character as it is a private data. Besides that, there are two tables inside the “TADB” database which act as temporary data storage which are “SessionDB” and “TempDB”. Both tables are essential to the program flows. In order to increase the security, both databases are password protected.

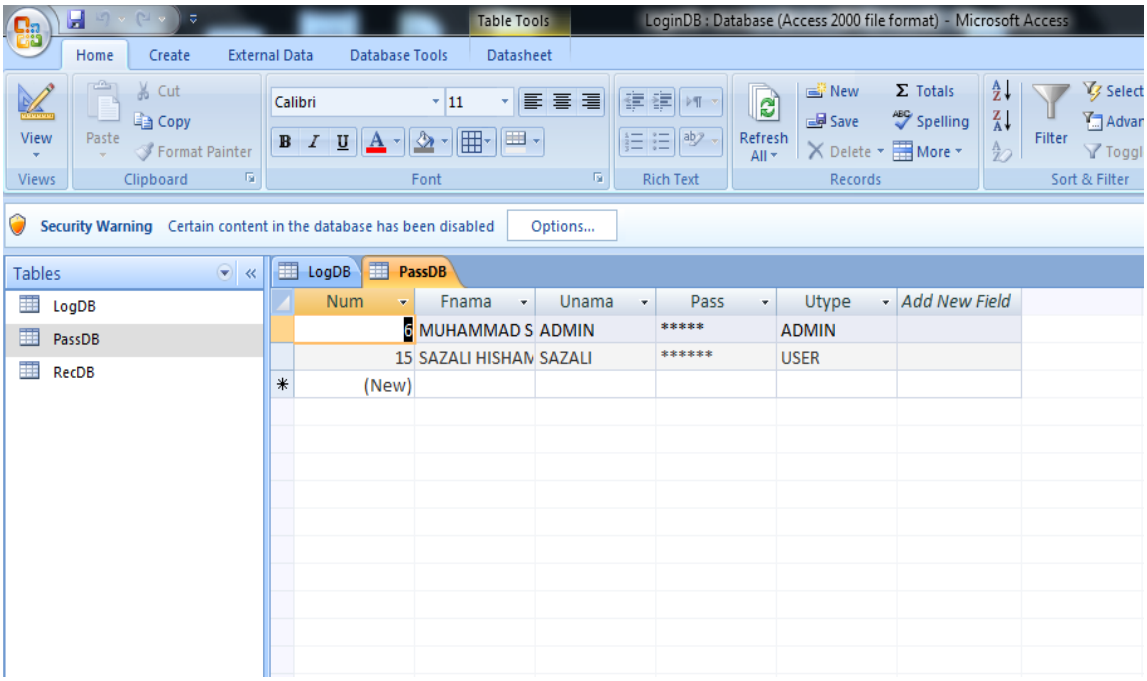

Figure 3.5: "LoginDB" Database

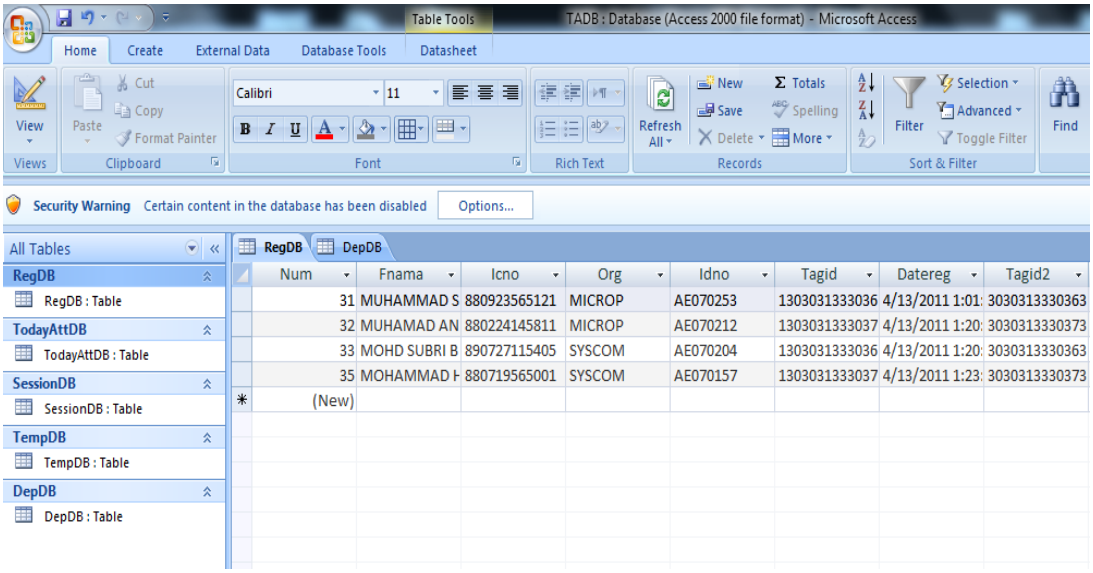

Figure 3.6: "TADB" Database

3.2.2 GUI Design

As mentioned before, the GUI of the Time Attendance and the Remote Monitoring Client is developed using Microsoft Visual Studio 2008. However, it is difficult to design an attractive GUI using the basic controls provided by the Microsoft Visual Studio. Thus, third party add-on software which is Developer Express 2010 has been used to enhance the appearance of the GUI. This software is integrated into Microsoft Visual Studio 2010.

3.2.2.1 Time Attendance GUI

The Time Attendance interface is divided into two parts which are login part and the main interface part. The purpose of the login part is to make the system more secure as user has to login before having the access of the main interface. The folder of the design project is named “Final GUI” and the project file name is “FGUI”. The output of the compilation is in “Debug” folder within the project folder. The flowchart of login transaction is shown in **Figure 3.7**

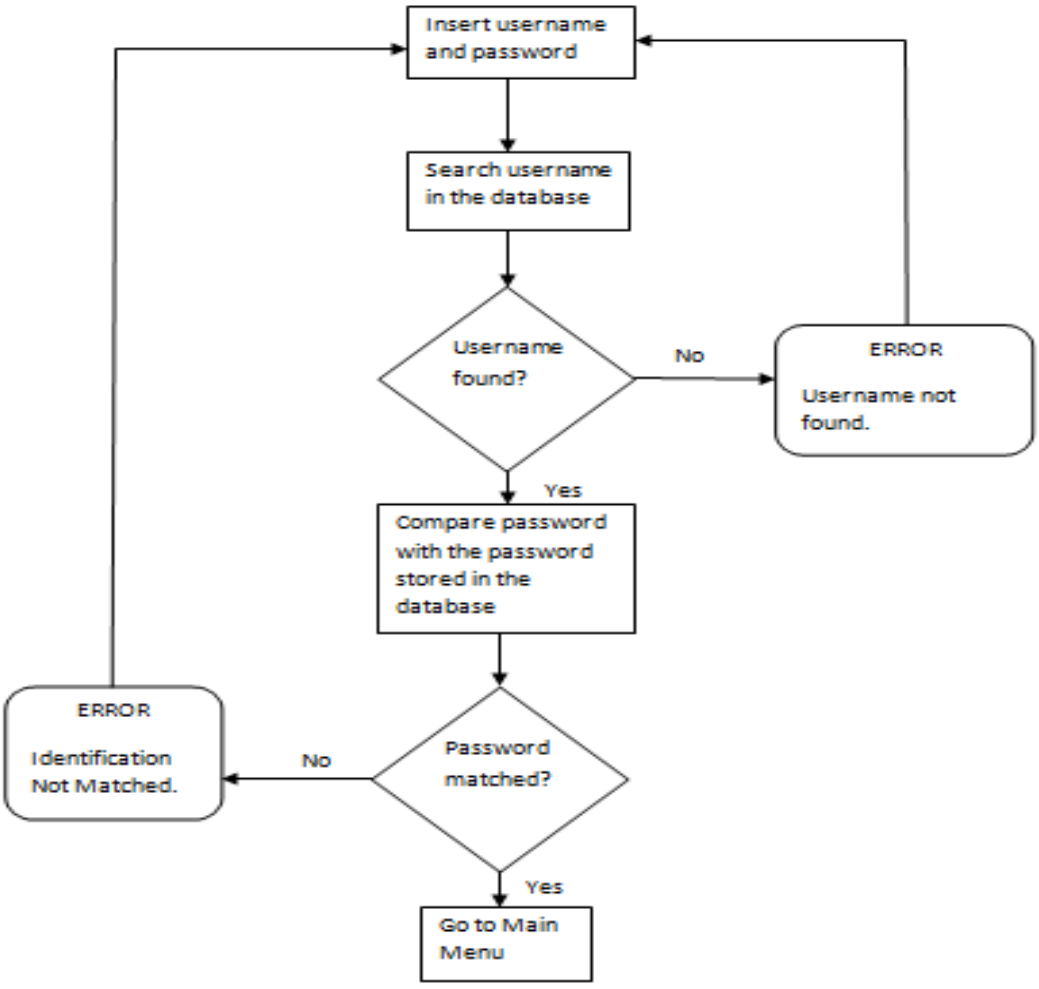

Figure 3.7: Flowchart of login transaction

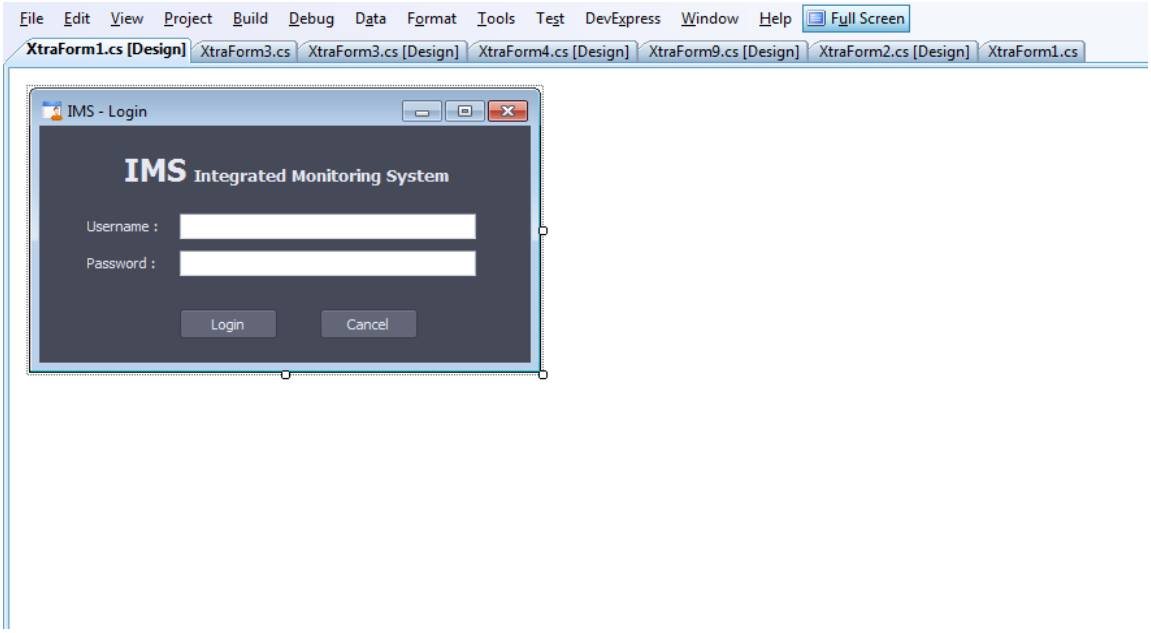

Figure 3.8: System Login Design

Figure 3.8 shows the design of the system login interface. “Login” button handles the login event by searching the username and password inserted in the corresponding textboxes in the database for matched ID. The “Cancel” button control is responsible to close the application. The design names of the textboxes are “tb_uname” and “tb_pass”.

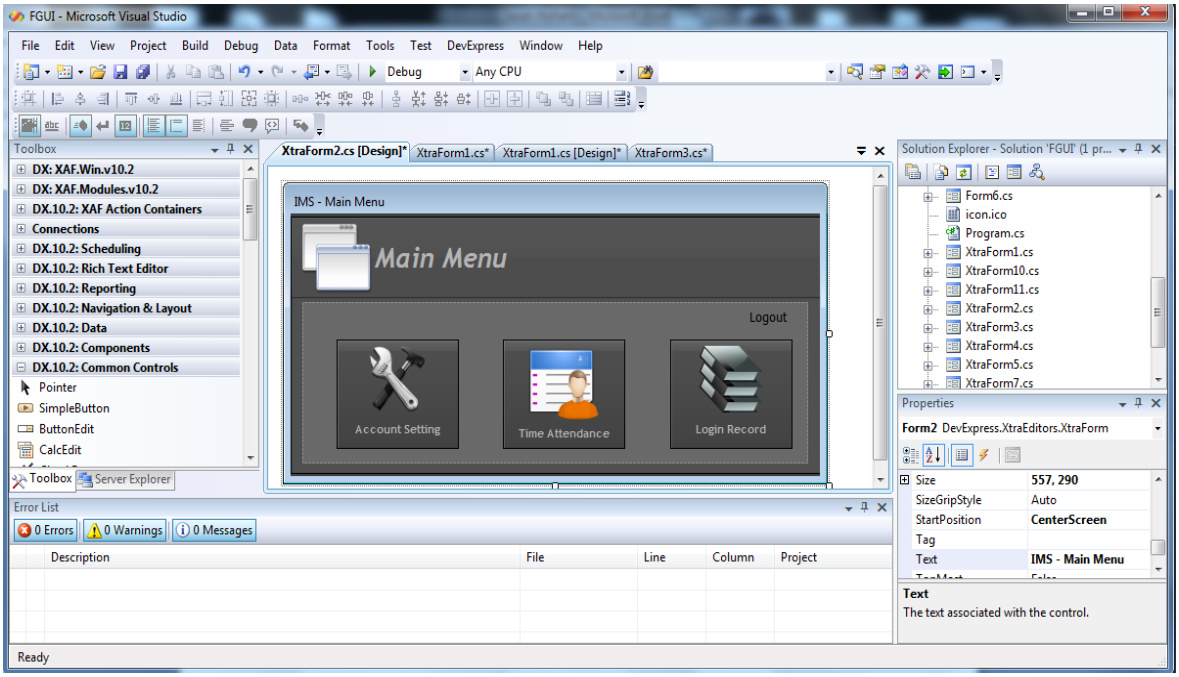

Figure 3.9: Main Menu Interface Design

Figure 3.9 shows the GUI design of Main Menu. This interface act as an intermediary interface because the three buttons, “Account Setting”, ’Time Attendance”, and “Login Record” only responsible to call their corresponding forms. The button “Logout” used to return to the System Login form.

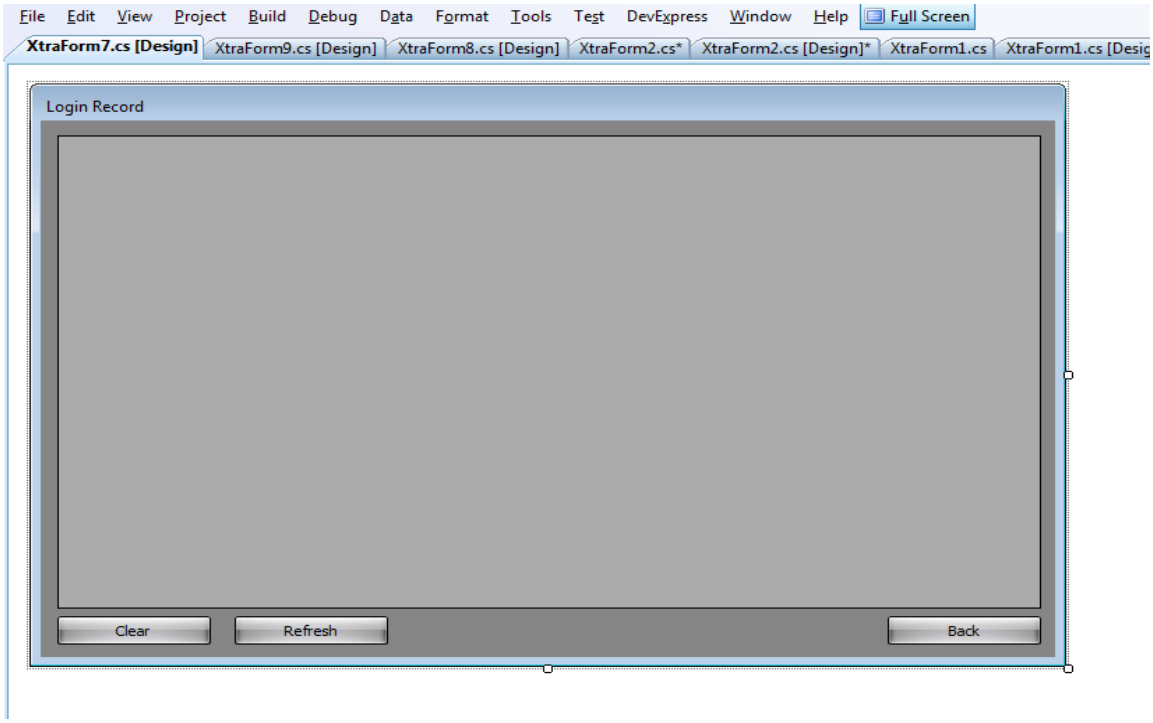

Figure 3.10: Login Record GUI Design

Figure 3.10 shows the GUI design of Login Record. In order to display the record, a data grid view control has been used. Three button controls also included which are “Back”, “Clear” and “Refresh”. “Back” button used to return to the Main Menu. “Clear” button handles on clearing the record permanently while “Refresh” button used to update the grid view. The design name of this interface is “Form 7”.

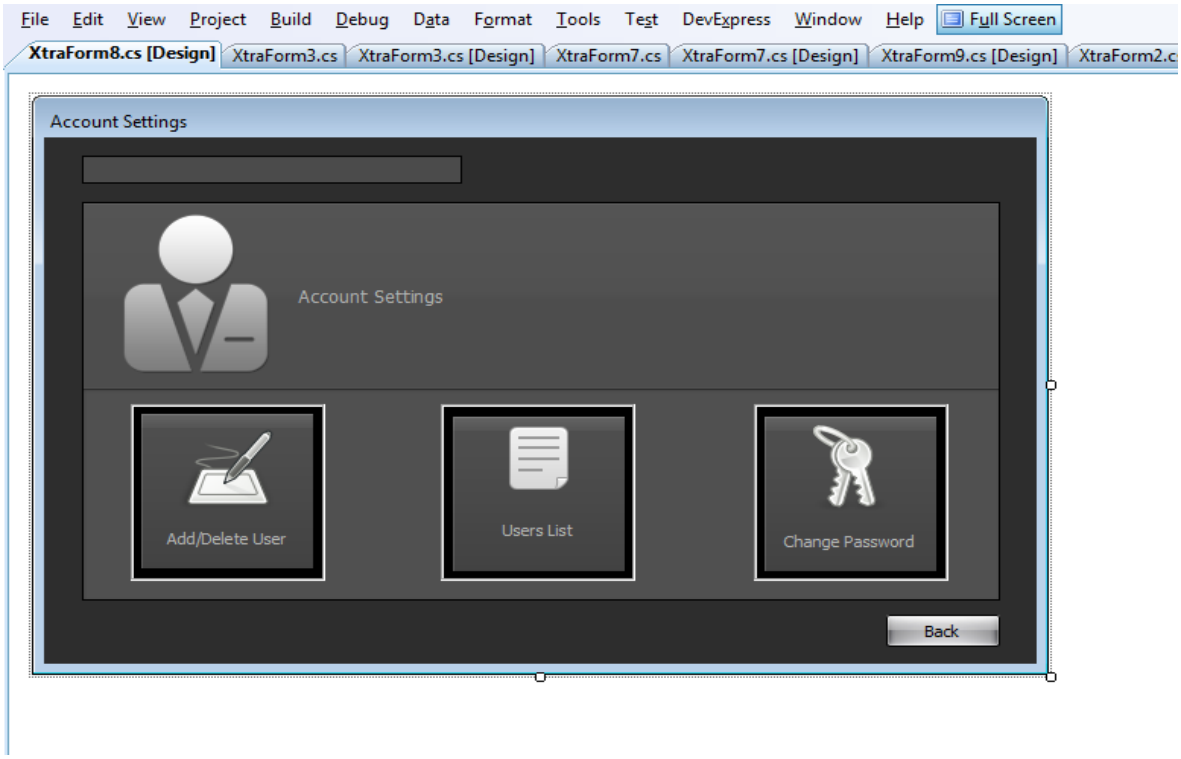

Figure 3.11: Account Setting GUI Design

Figure 3.11 shows the GUI design of Account Setting. Three button controls, "Add/Delete User", "User List" and "Change Password" included in this interface as the main control to call their respective form. A textbox with design name "tb_logas" used to display the name of user who logged in. "Back" button control used to return to previous form.

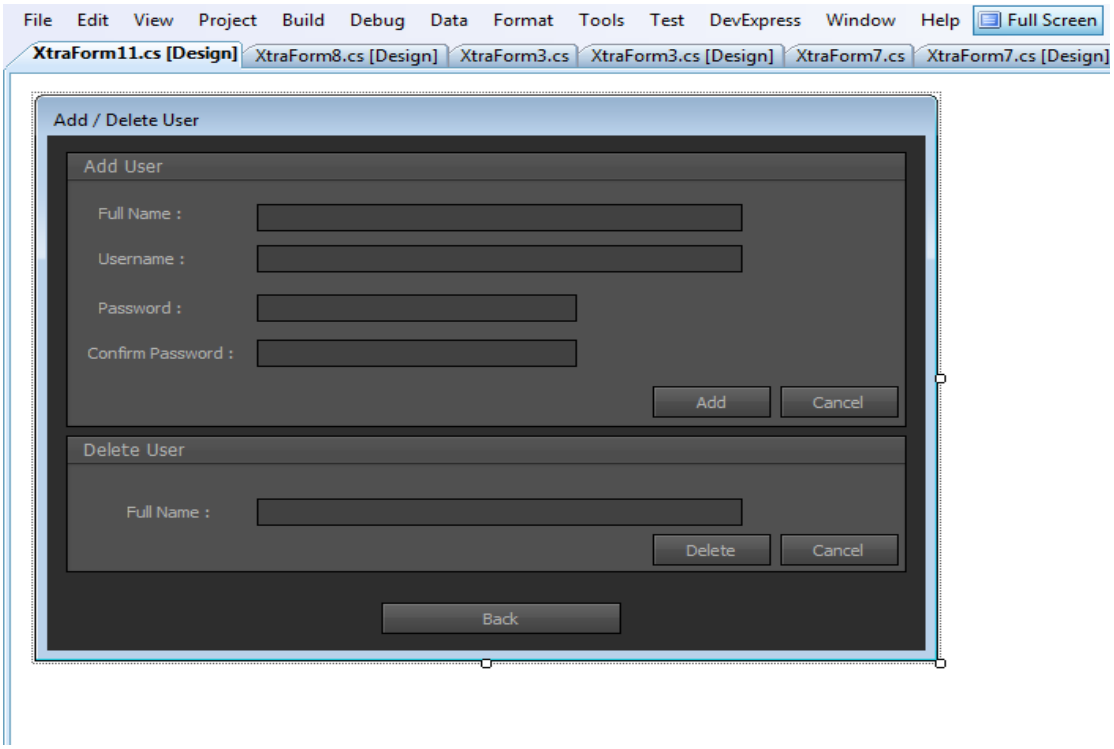

Figure 3.12: Add/Delete User GUI Design

Figure 3.12 shows the interface design of Add/Delete User, the form that will be called when button "Add/Delete User" in the Account Setting form pressed. The design name of this form is "Form11".The design name for the textboxes are "tb_fnama"(fullname),"tb_unama"(username), tb_pass"(password), "tb_npass"(confirm password) and "tb_delfnama"(delete fullname).

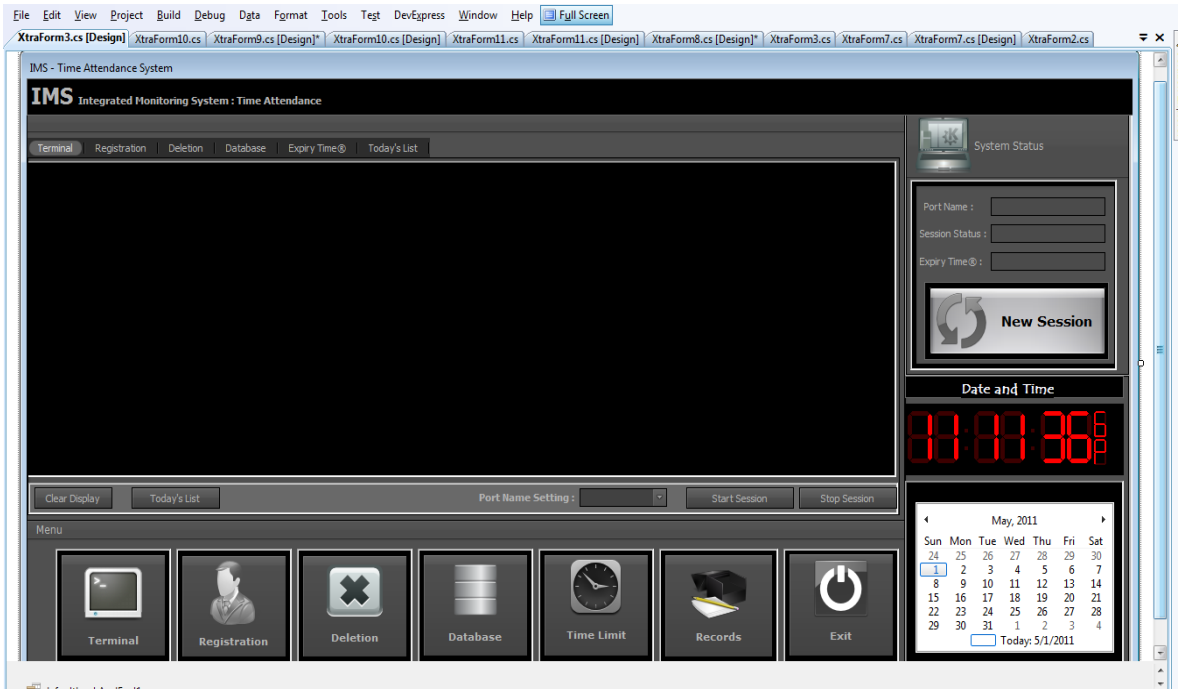

Figure 3.13: Time Attendance Main GUI Design

Figure 3.13 shows the Time Attendance Main Interface Design. Tab control has been used to reduce forms required to implement the main features available. Features included in this interface are live transaction terminal, ID registration, ID deletion, view database, searching, set time limit, and view session record. Button controls in the Menu used to open the tab respectively according to their names, except “Exit” button which used to close this form and return to Main Menu form and also “Records” button which use open file dialog control to open the record files. Default tab opened when this form has loaded is the terminal tab as shown in **Figure 3.13**

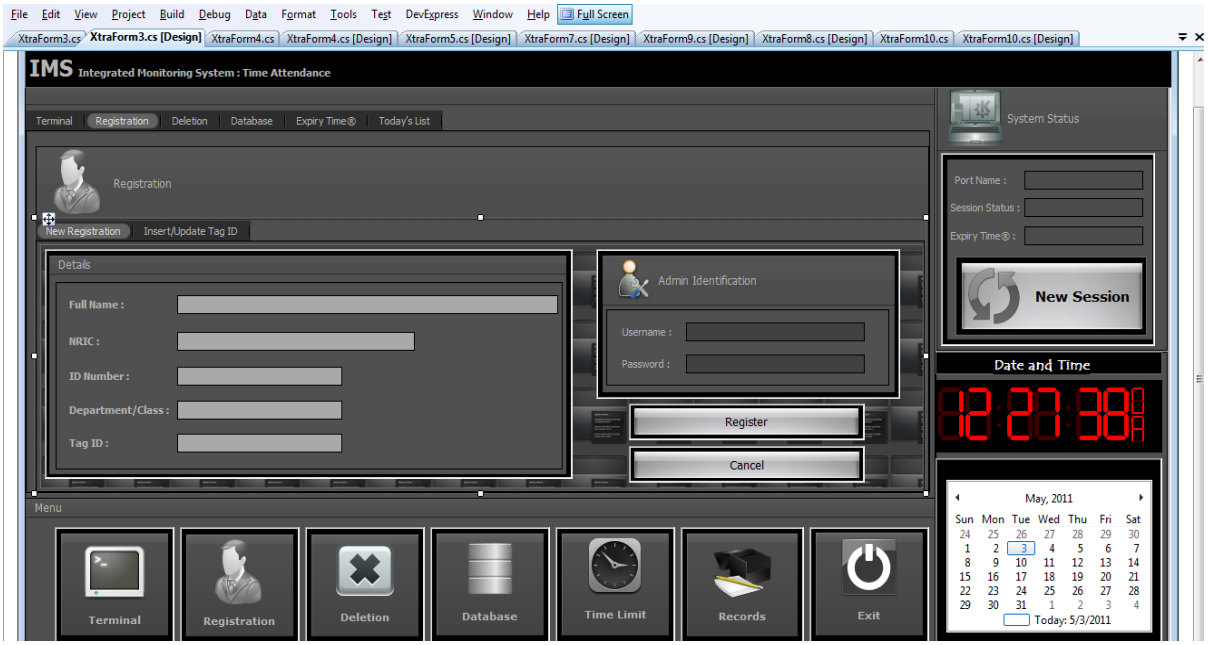

Figure 3.14: New Registration Interface Design

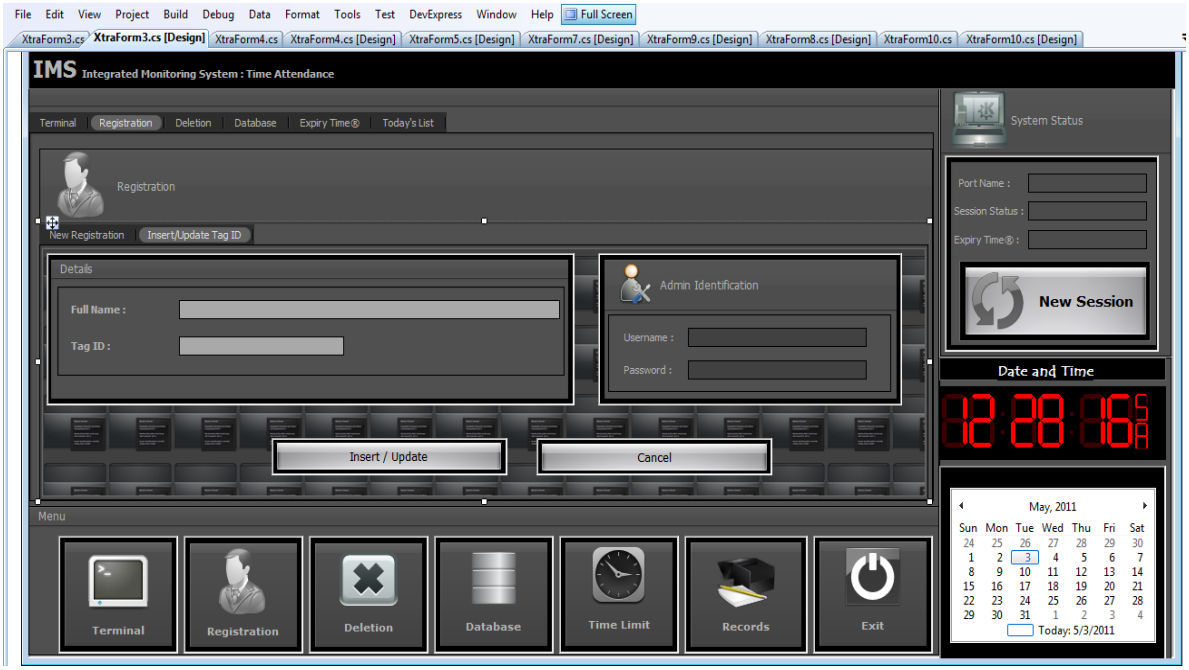

Figure 3.15: Insert/Update Tag ID Interface Design

The design of Registration interface is consist of two tabbed interfaces which are New Registration and Insert/Update Tag ID as shown in **Figure 3.14** and **Figure 3.15**. New Registration interface used to execute full registration. In contrast, Insert/Update Tag ID interface is used if the details inserted manually to database via Microsoft Access except for the tag ID. This is because the tag ID stored in the database in hexadecimal format instead of its default format which is ASCII format. Thus the interface provides the converter from ASCII format to hexadecimal format before the tag ID is stored into the database. In this design, Admin Identification feature also has been built in order to enable only Administrator type of user can makes the registration operation. The New Registration implementation should follow the flowchart in **Figure 3.16**

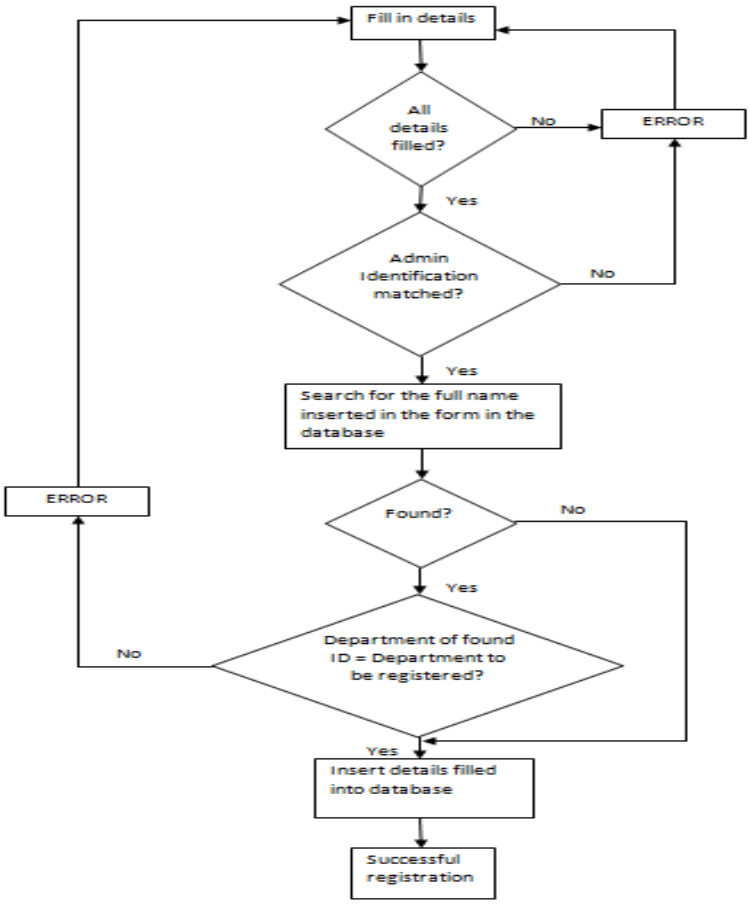

Figure 3.16: Flowchart of New Registration operation

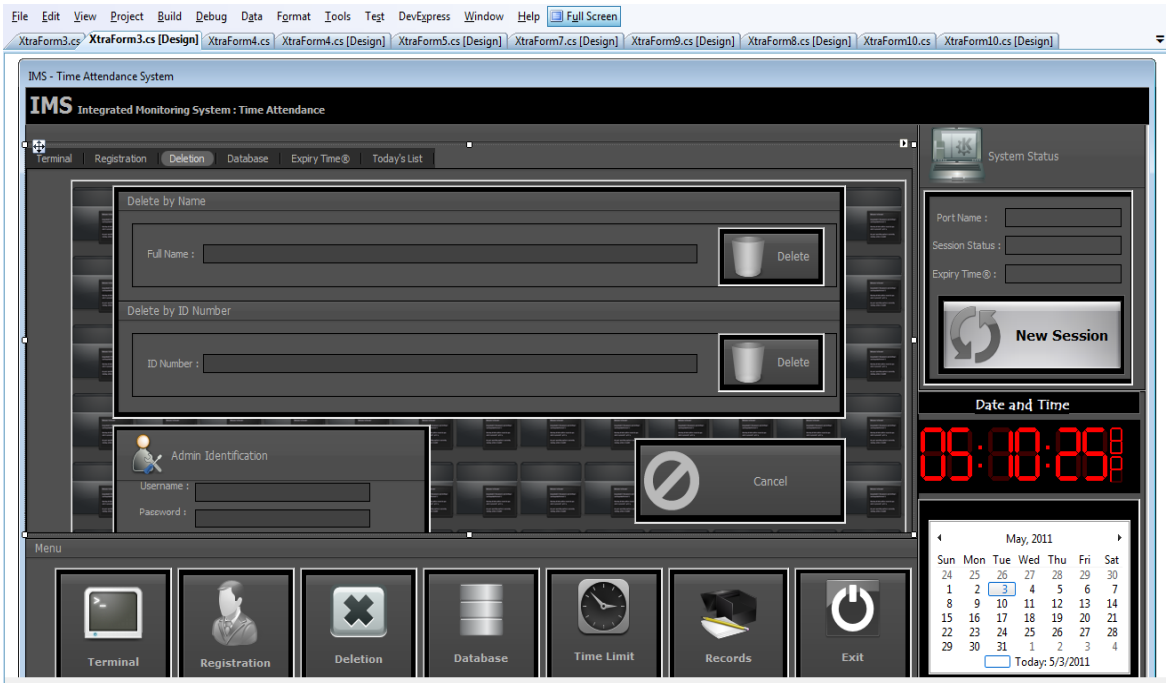

Figure 3.17: Deletion Interface Design

Figure 3.17 shows the Deletion interface design. An ID can be deleted by inserting its full name or its ID number. This operation will also require Admin Identification as same as Registration operation. The flowchart of Deletion operation is shown in **Figure 3.18**

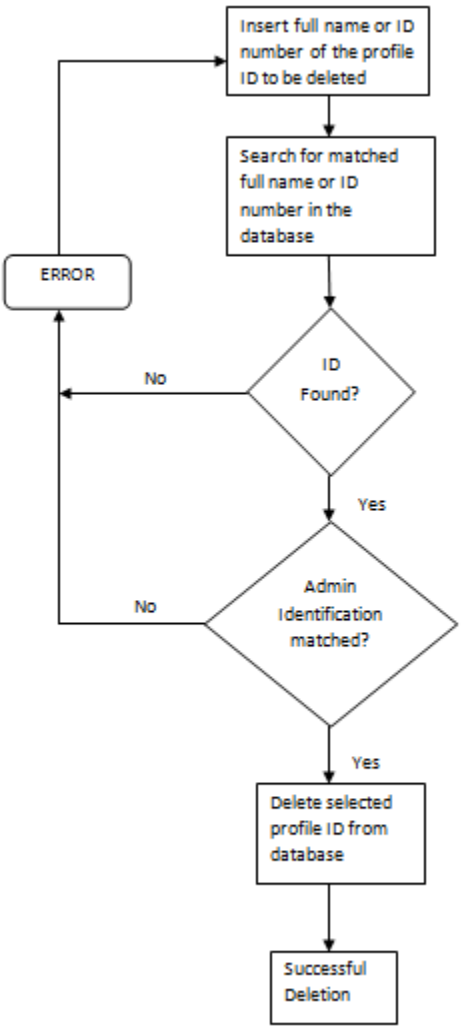

Figure 3.18: Flowchart of Delete ID Event

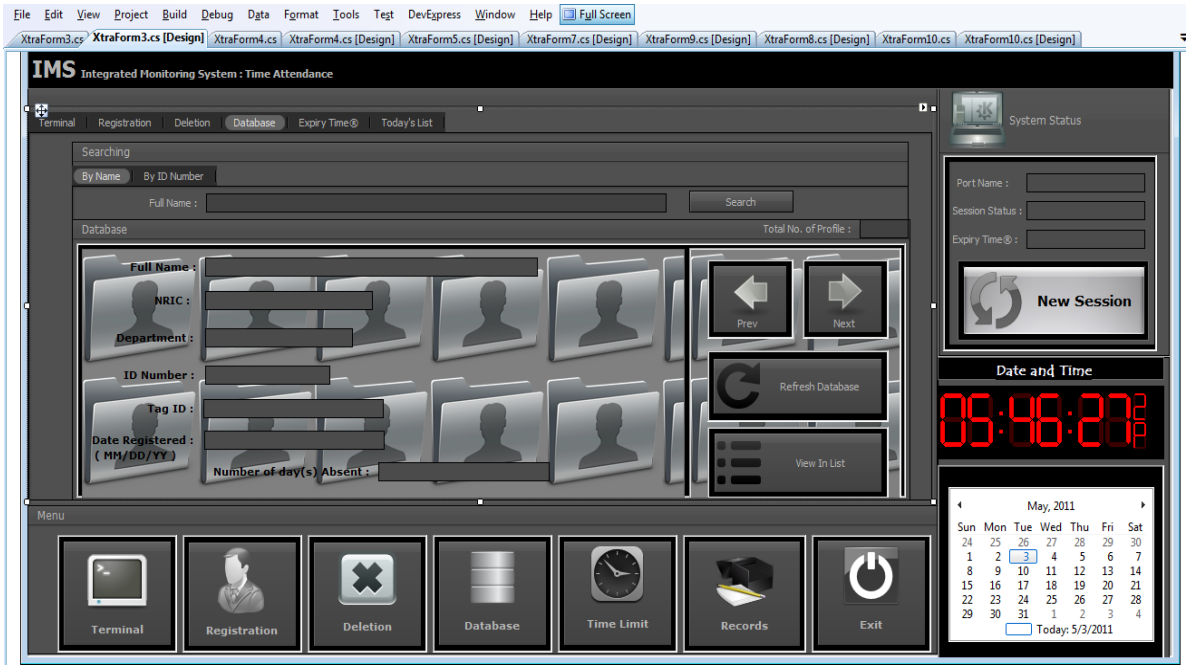

Figure 3.19: Database GUI Design

Figure 3.19 shows the database GUI design. This interface used to display the details of every registered profile ID. The number of days absent per meeting also can be viewed via this interface. Besides that, any profile ID can be searched via this interface by inserting its full name or ID number in the search's textbox. A less detailed database view also provided by clicking the button "View In List" which will call another form that uses data grid view control to display the database.

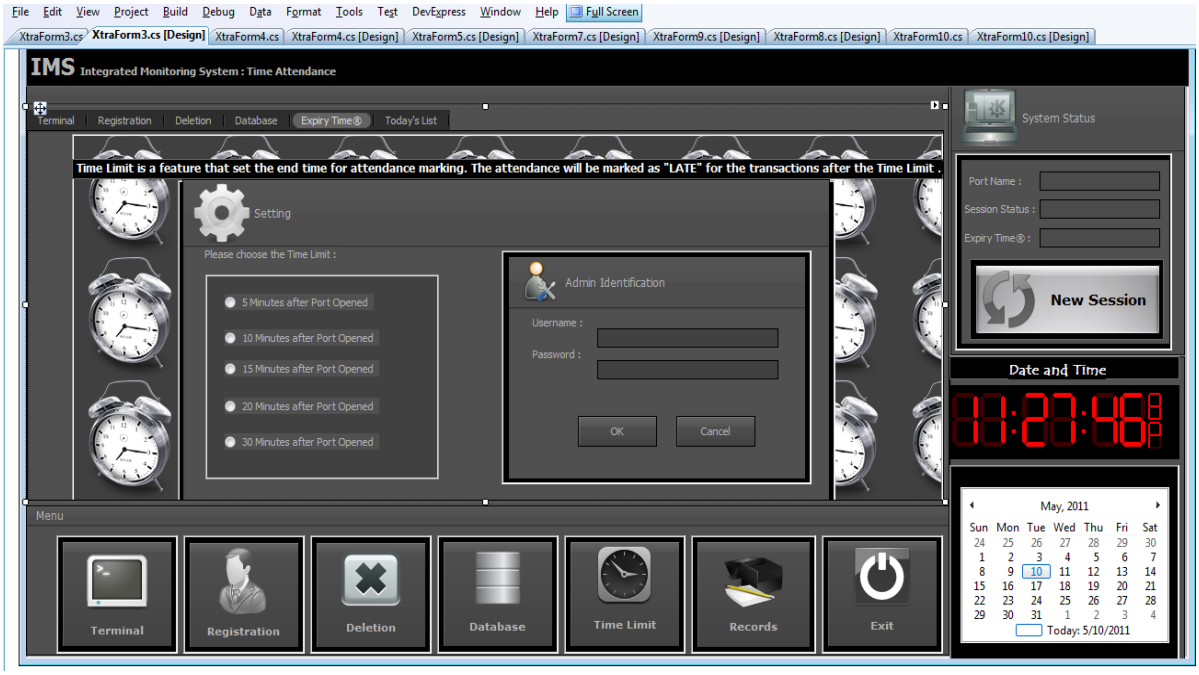

Figure 3.20: Time Limit GUI Design

Figure 3.20 shows the time limit GUI design. This interface used to set the time limit after a session has been created. Radio button control has been used as the options of the time range. The range of time available is between 5 to 30 minutes after the port has been opened. When the time limit has end, the attendees that scan their tags should be marked as late. An identification to enable this feature also provided. However, this feature can be enabled by using both admin and guest user account as the username and password in the admin identification.

3.2.2.2 Remote Monitoring Client GUI

Two forms have been used to develop the Remote Monitoring Client GUI which is login form and the monitor form. The login information is inserted in the login form while the monitor form will provides the view and control of the host computer. The view and the control of the host computer are gained by using the Microsoft Terminal Service Control Library. The GUI design of these forms are shown in **Figure 3.21** and **Figure 3.22**

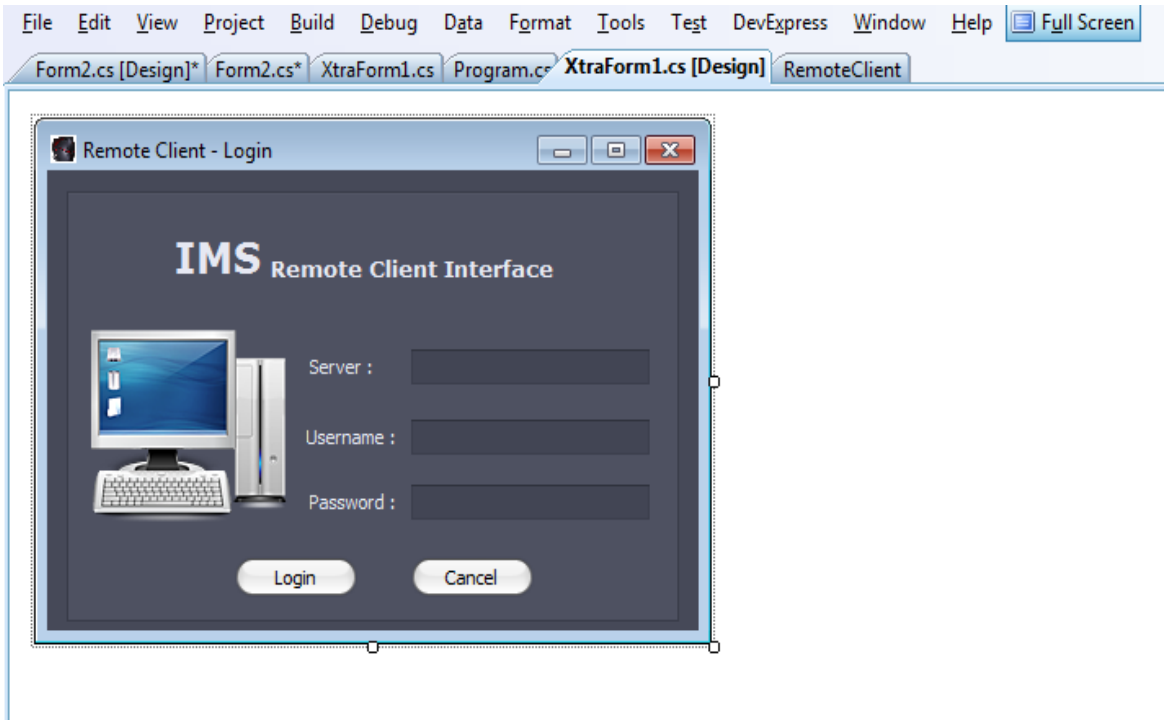

Figure 3.21: Login Form Design

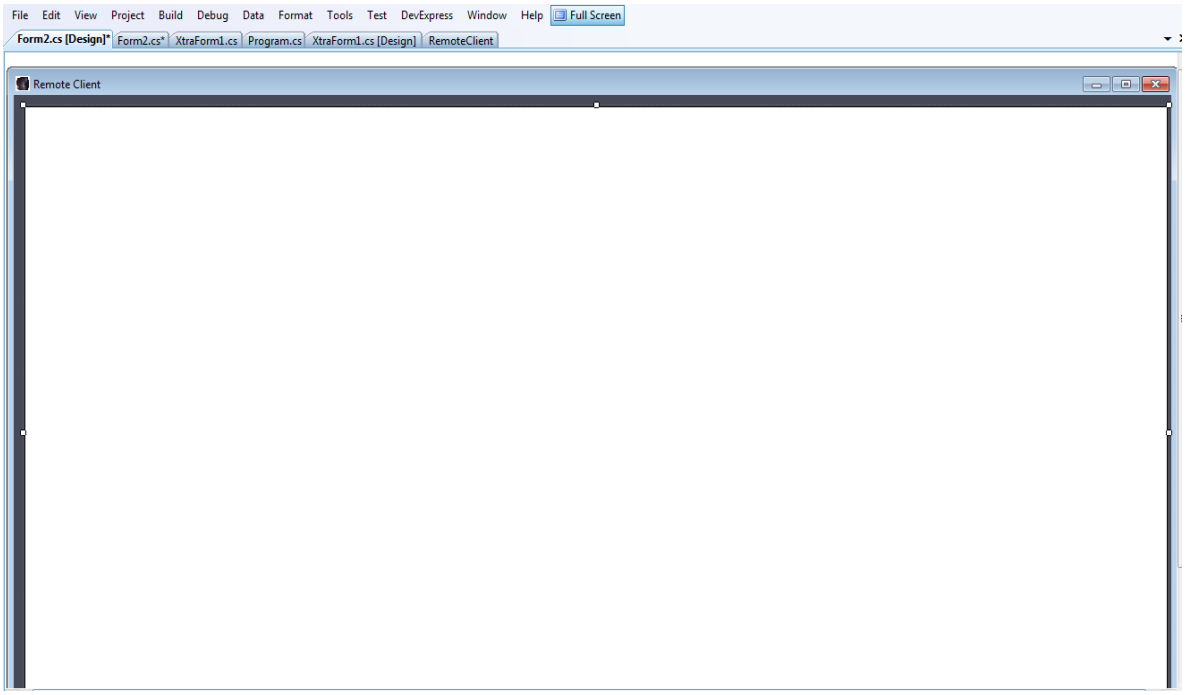

Figure 3.22: Monitor Form Design

3.2.3 Coding Technique

The code behind the interface is mostly class-based code as in C#.NET, every control has its own class library that provide the desired output when the controls have been interrupted. Functions also have been used to make the program well organized.

3.2.3.1 Database Interfacing

As the database is built using Microsoft Access, the connection to the database can be established using *OleDb* connection. *DataAdapter* also been used to implement dataset method to get the data from the database. The example of source code used is shown in **Figure 3.23**

```
#region Instance Declaration
public OleDbConnection database;
DataSet ds1;
DataSet ds2;
System.Data.OleDb.OleDbDataAdapter da;
System.Data.OleDb.OleDbDataAdapter da1;
System.Data.OleDb.OleDbDataAdapter da2;
System.Data.OleDb.OleDbDataAdapter da3;
System.Data.OleDb.OleDbDataAdapter da4;
System.Data.OleDb.OleDbDataAdapter da5;
#endregion

Connecting to the Database
string connectionString = "Provider=Microsoft.Jet.OLEDB.4.0;Data
Source=Databases\\LoginDB.mdb;Jet OLEDB:Database Password= admin";
database = new OleDbConnection(connectionString);
database.Open();
string sql = "SELECT * FROM PassDB";
ds1 = new DataSet();
da = new System.Data.OleDb.OleDbDataAdapter(sql, database);
da.Fill(ds1, "PassDB");
da1 = new System.Data.OleDb.OleDbDataAdapter("SELECT * FROM LogDB",
database);
da1.Fill(ds1, "LogDB");
```

Figure 3.23: Source Code used to connect to the database

3.2.3.2 Database Queries

SQL statements such as *INSERT*, *DELETE* and *UPDATE* are used to retrieve and manipulate data in the database. Besides that, getting data row from dataset method also been used to retrieve the data without manipulate it as used to display the data in the database interface. Furthermore, *try-catch* statement is implemented to control the program exception during the queries.

```
string SQLString;
SQLString = "INSERT INTO
RegDB(Fnama,Icno,Org,Idno,Tagid,Datereg,Tagid2)VALUES('" +
name.Replace("'", "''") + "','" + nric + "','" + org + "','" + idno +
"','" + "1" + ConvertToHex(tagid) + "2" + "','" + DateTime.Now + "','"
+ ConvertToHex(tagid) + "');";
OleDbCommand SQLCommand = new OleDbCommand();
SQLCommand.CommandText = SQLString;
SQLCommand.Connection = database;
int response = -1;
try{
response = SQLCommand.ExecuteNonQuery();}
catch (Exception ex){
MessageBox.Show(ex.Message);}
if (response >= 1){}
```

Figure 3.24: Example of the usage of SQL queries with try-catch statement

```
DataRow dr = ds2.Tables["RegDB"].Rows[inc];
tb_fname.Text = dr.ItemArray.GetValue(1).ToString();
tb_nric.Text = dr.ItemArray.GetValue(2).ToString();
tb_dep.Text = dr.ItemArray.GetValue(3).ToString();
tb_idno.Text = dr.ItemArray.GetValue(4).ToString();
string x = dr.ItemArray.GetValue(7).ToString();
tb_tagid.Text = HexString2Ascii(x);
tb_datereg.Text = dr.ItemArray.GetValue(6).ToString();
```

Figure 3.25: Displaying data in database interface using data row method

3.2.3.3 ASCII to Hexadecimal Converter

In order to convert ASCII format number into hexadecimal, *String.format* command used. A for each loop also used to convert every single ASCII character. The function is shown in **Figure 3.26**

```
public string ConvertToHex(string asciiString)
{
  string hex = "";
  foreach (char c in asciiString)
  {
      int tmp = c;
      hex += String.Format("{0:x2}",
      (uint)System.Convert.ToUInt32(tmp.ToString()));
  }
  return hex;
}
```

Figure 3.26: ASCII to Hexadecimal Converter

3.2.3.4 Comparing Two Time Format Number

Time limit feature needs the comparison of the end time and the time the tag ID scanned. However it cannot be arithmetically subtracted as time format number is not the same of integer format number. Thus, *DateTime.Compare(Time1 , Time2)* command is used instead. *Time1* is the first parameter that will be compared to *Time2*.

3.2.3.5 Serial Port Interfacing

Microsoft Visual Studio provides the serial port class library to make communication between serial port and the window form. The *SerialPort.DataReceived* need to be declared as it is the event handler to read the data from the serial port buffer as shown in **Figure 3.27**. This method is interrupt-driven.

```
 private SerialPort comPort = new SerialPort();

comPort.DataReceived += new
SerialDataReceivedEventHandler(comPort_DataReceived);
```

Figure 3.27: SerialPort.DataReceived declaration

The data from the serial port will be displayed on a rich textbox control. However, the serial port and the rich textbox control are using different threads. This by default will produce an exception during runtime as illegal cross-thread operation. Furthermore as both serial port and the window form control is trying to manipulate the same data simultaneously, race condition or deadlock may happen and the output will be incorrect. In order to make a thread-safe call, *delegate* method used to invoke the cross-thread operation as shown in **Figure 3.28**

```
private RichTextBox _displayWindow;

[STAThread]
private void DisplayData(MessageType type, string msg)
{
     _displayWindow.Invoke(new EventHandler(delegate
     {
       _displayWindow.SelectedText = string.Empty;
              _displayWindow.SelectionFont = new
      Font(_displayWindow.SelectionFont, FontStyle.Bold);
      _displayWindow.SelectionColor = MessageColor[(int)type];
      _displayWindow.AppendText(msg);
       _displayWindow.ScrollToCaret();
      }));
}
```

Figure 3.28: Cross-Thread operation using delegate method

```
void comPort_DataReceived(object sender,SerialDataReceivedEventArgs
e)
{

     int bytes = comPort.BytesToRead;
     byte[] comBuffer = new byte[bytes];
     comPort.Read(comBuffer, 0, bytes);
     string msg = ByteToHex(comBuffer);
      DisplayData(MessageType.Time, DateTime.Now + ": " + "\t");
     DisplayData(MessageType.Late, msg + "\n");


}
```

Figure 3.29: Basic DataReceived Event Handler

Figure 3.29 shows the basic function of *DataReceived* event handler to display the data from serial port in the rich textbox control by using *DisplayData* function. This function first creates an array of bytes to store the received bytes of data from the serial port buffer before reading the bytes. Then it will be displayed by using the *DisplayData* function. In order to display the name of the Tag ID holder, it will be compared to the database before being displayed as shown in the flowchart in **Figure 3.30**

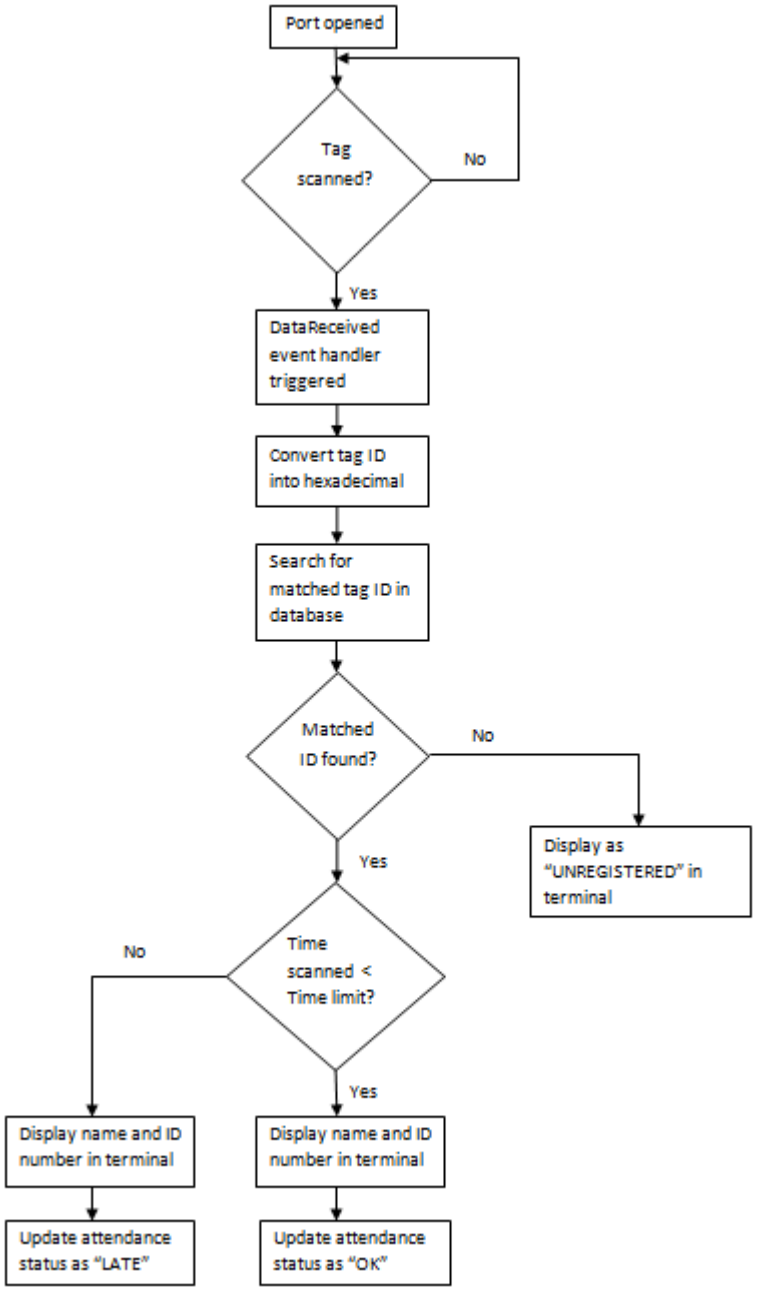

Figure 3.30: Flowchart of Scanning Tag ID Transact

CHAPTER 4

RESULT AND DISCUSSION

4.1 RFID Reader Output Test

HyperTerminal application has been used to view the output of the RFID reader after reading the tag as shown in **Figure 4.1**. The output of the reader is 12 bytes data in ASCII. The weird characters at the first byte and the last byte are extra byte to indicate the start and the end of the data. The 10 bytes data between it is the tag unique ID.

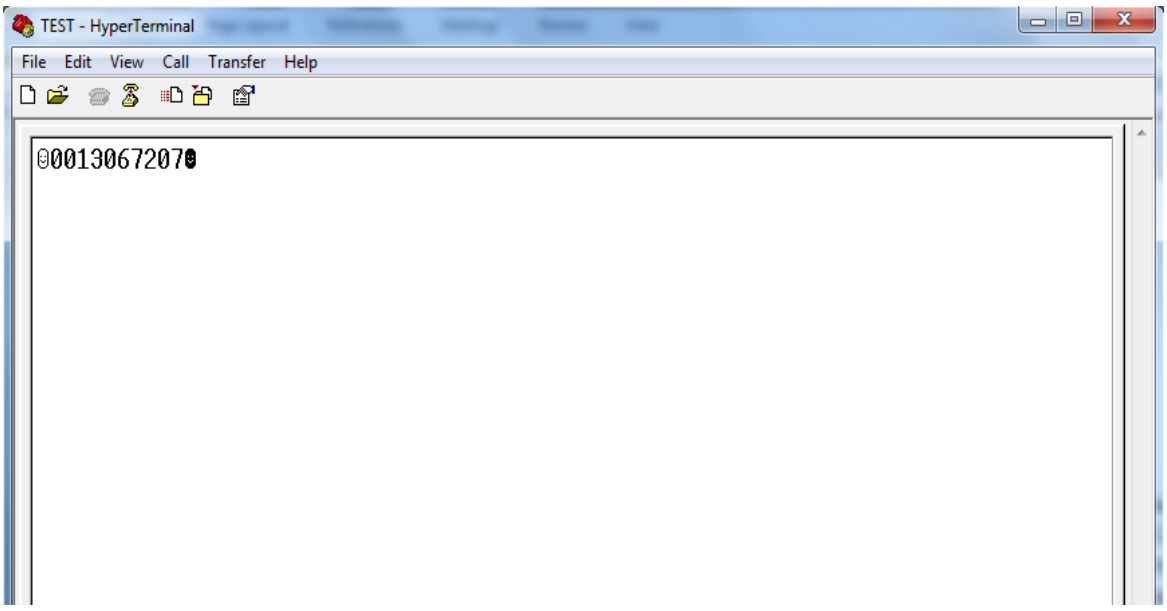

Figure 4.1: RFID reader output test in HyperTerminal application

4.2 System Login

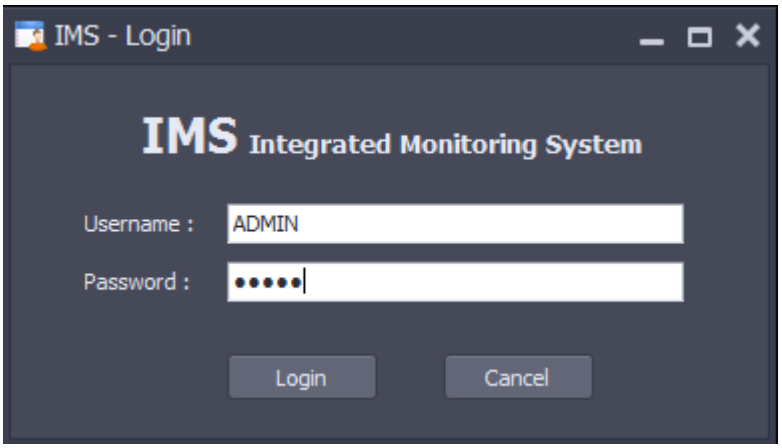

Figure 4.2: Login Form

Figure 4.2 shows the login form to get the access of the Time Attendance system. There are two types of user which are administrator and guest user. Administrator has no data manipulation restriction while guest user has some limitation. The type of user is identified by comparing the details filled in the form with the details matched in the database.

4.3 Main Menu

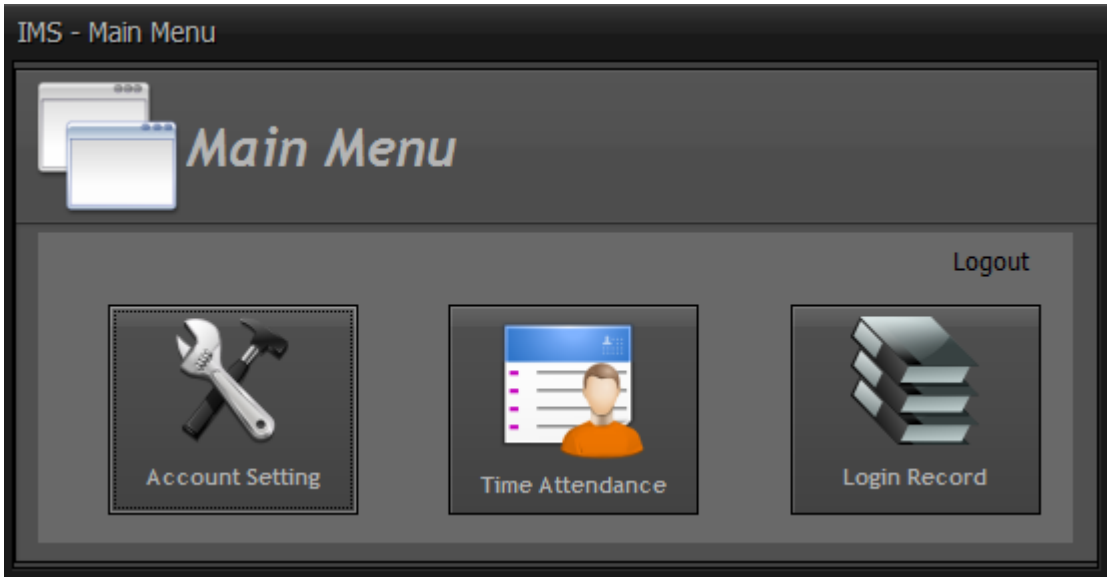

Figure 4.3: Main Menu

Figure 4.3 shows the main menu of the system. There are three options which are account setting, time attendance and login record. Time attendance menu is chosen to access the time attendance system. Login record displays the record of all login transaction as shown in **Figure 4.4**

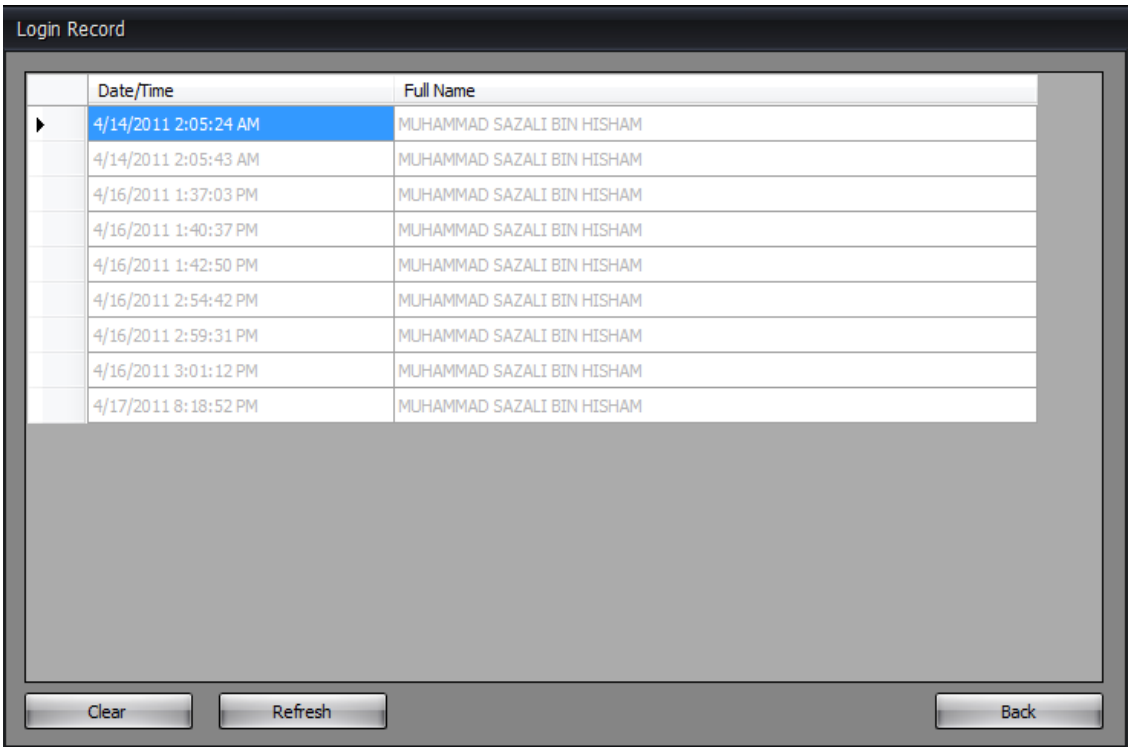

Figure 4.4: Login Record

4.4 Account Setting

In the account setting, there are three menus which are Add or Delete User, User List and Change Password. However, guest user is restricted from add or delete user and view user list. Only password change can be done by guest user. **Figure 4.5** and **Figure 4.6** shows the limitation in account setting menu using different account type.

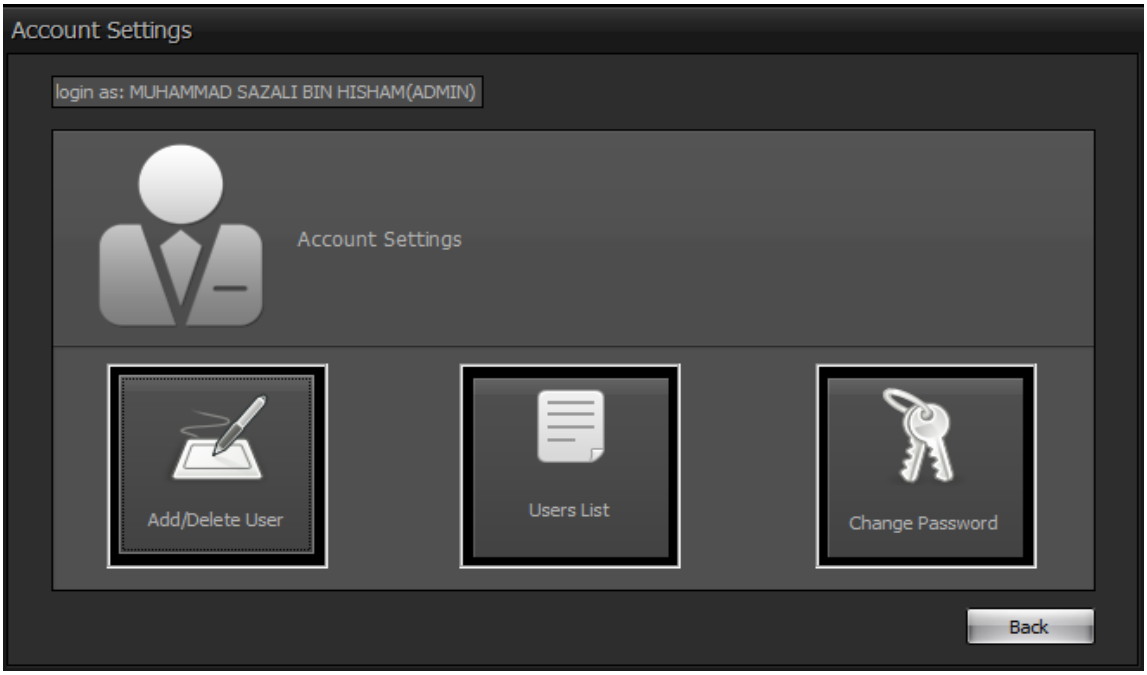

Figure 4.5: Account Setting for Administration

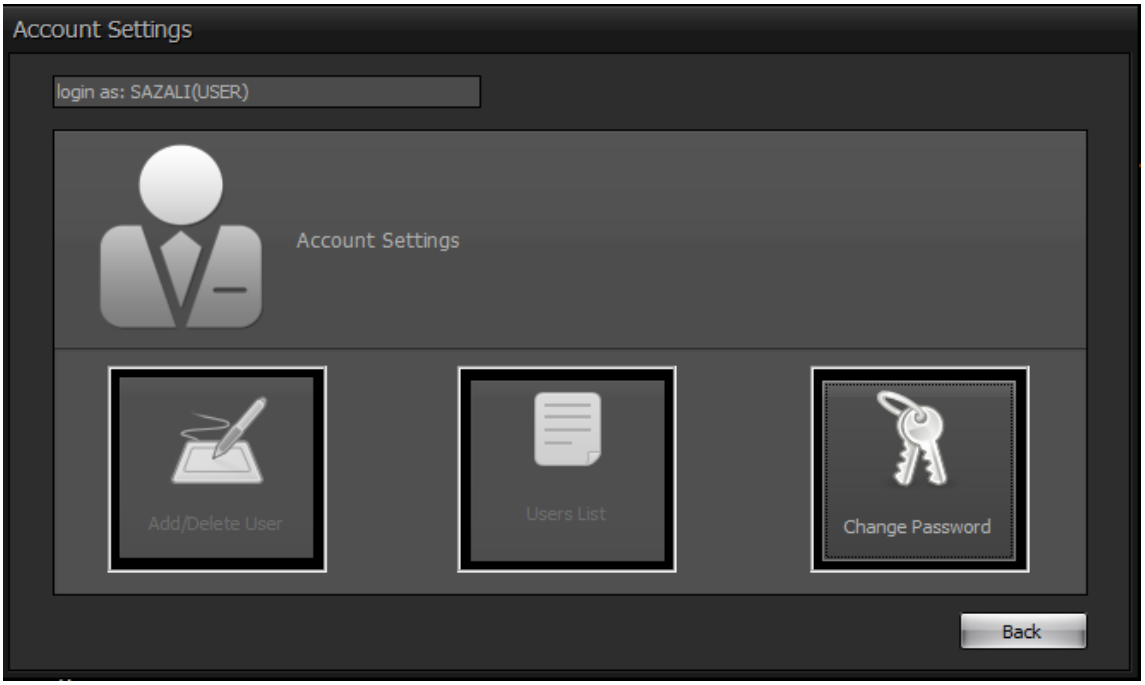

Figure 4.6: Account Setting for Guest User

4.4.1 Adding or Deleting User

This menu provides the interface for administrator to add or delete user. However administrator's account itself cannot be deleted and there is only one administrator account in this system. In the other words, only guest user can be added into the database. Username that is same with one of the username stored in the database cannot be deleted.

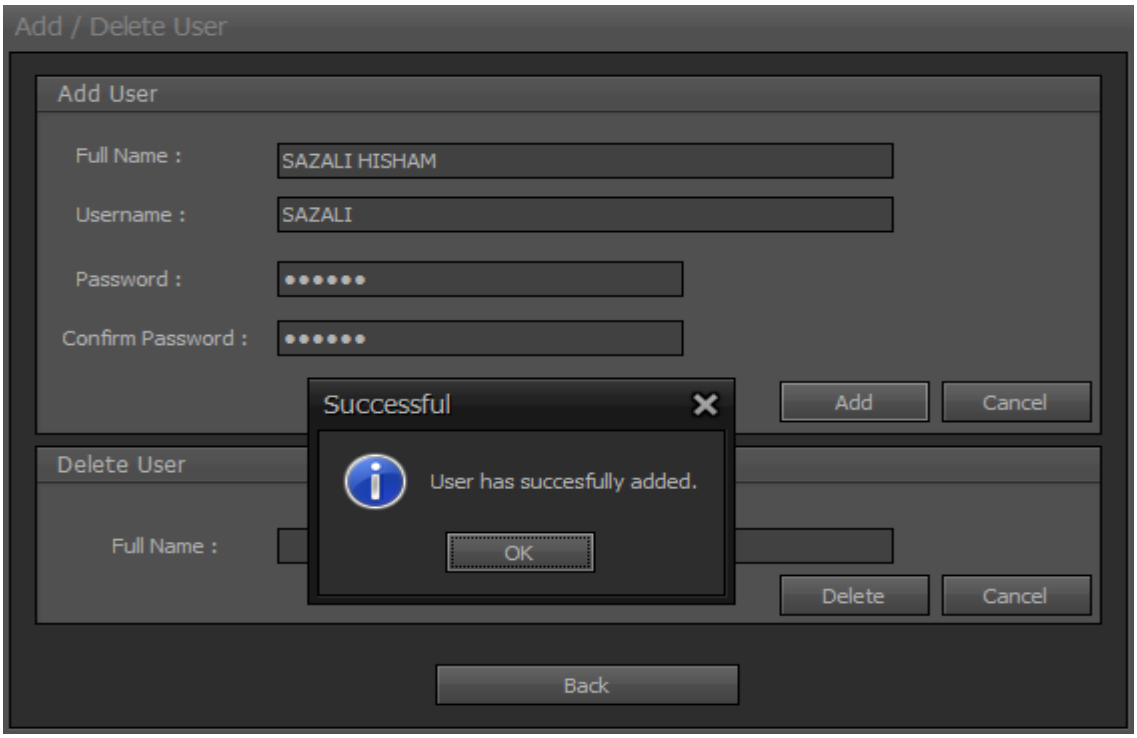

Figure 4.7: Add/Delete User Interface

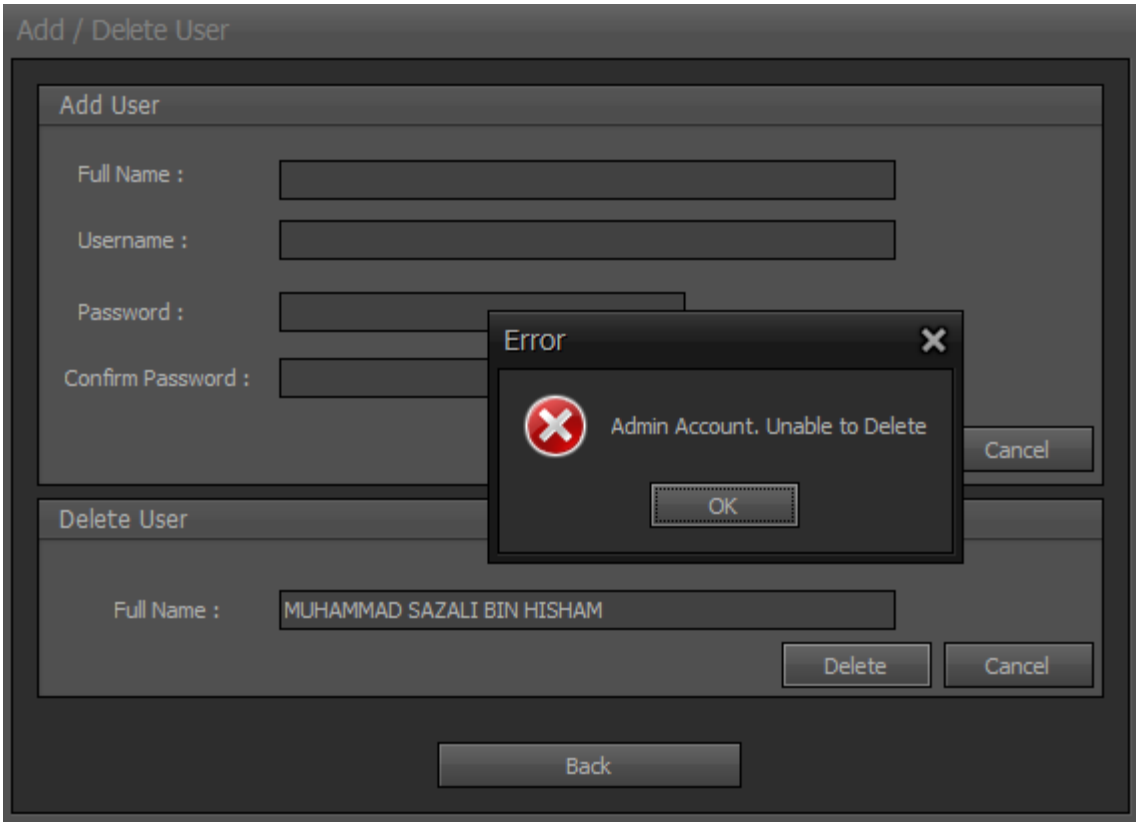

Figure 4.8: Prohibition from deleting administrator account

4.4.2 User List

The User List interface shows the registered user that can access the Time Attendance system. Only the administrator can view the list. The list shows user's full name, username and the type of account. The interface is shown in **Figure 4.9**

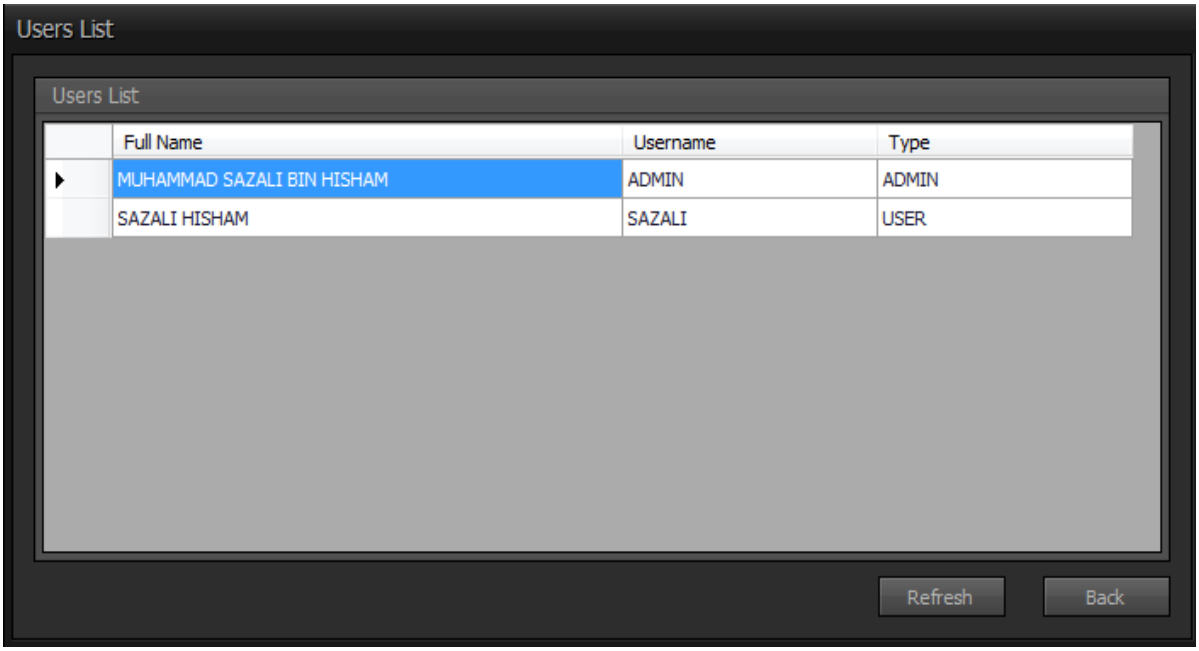

Figure 4.9: User List Interface

4.4.3 Change Password

The system also enables the user to change their corresponding password. Both administrator and guest user have the access of this interface as this is a private setting for every user. The interface shown in **Figure 4.10**

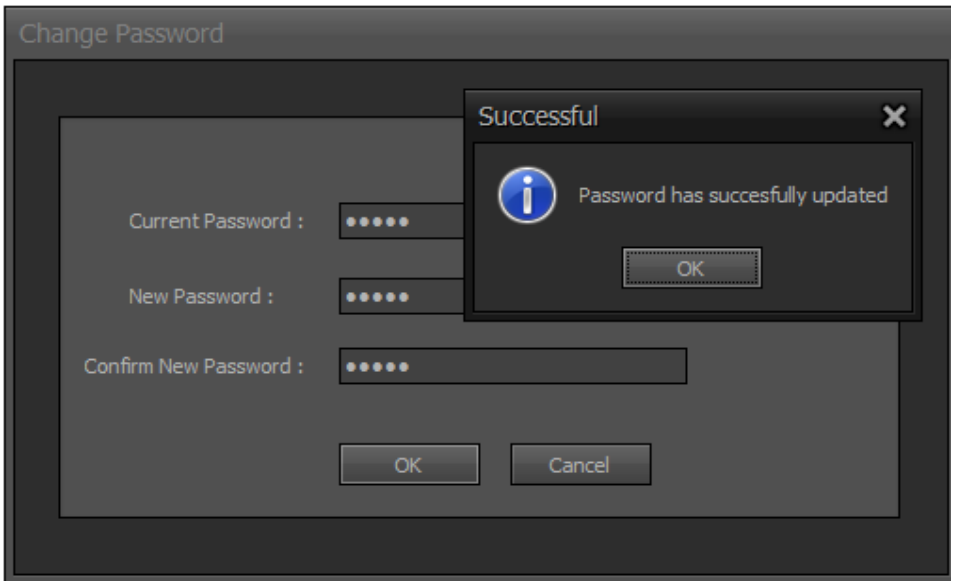

Figure 4.10: Change Password Interface

4.5 Time Attendance Main Interface

Figure 4.11: Time Attendance Interface

Figure 4.11 shows the main interface of the Time Attendance. There are seven menus which are Terminal, Registration, Deletion, Database, Time Limit, Records, and Exit. The System Status shows the current status of the system such as whether a session is running or otherwise, and whether the time limit has been set or otherwise. The Exit menu will close the form and return to the Main Menu interface while the other menus will open the corresponding tab. The System Status will show the configuration status of the port name, session, and time limit.

4.5.1 Registration

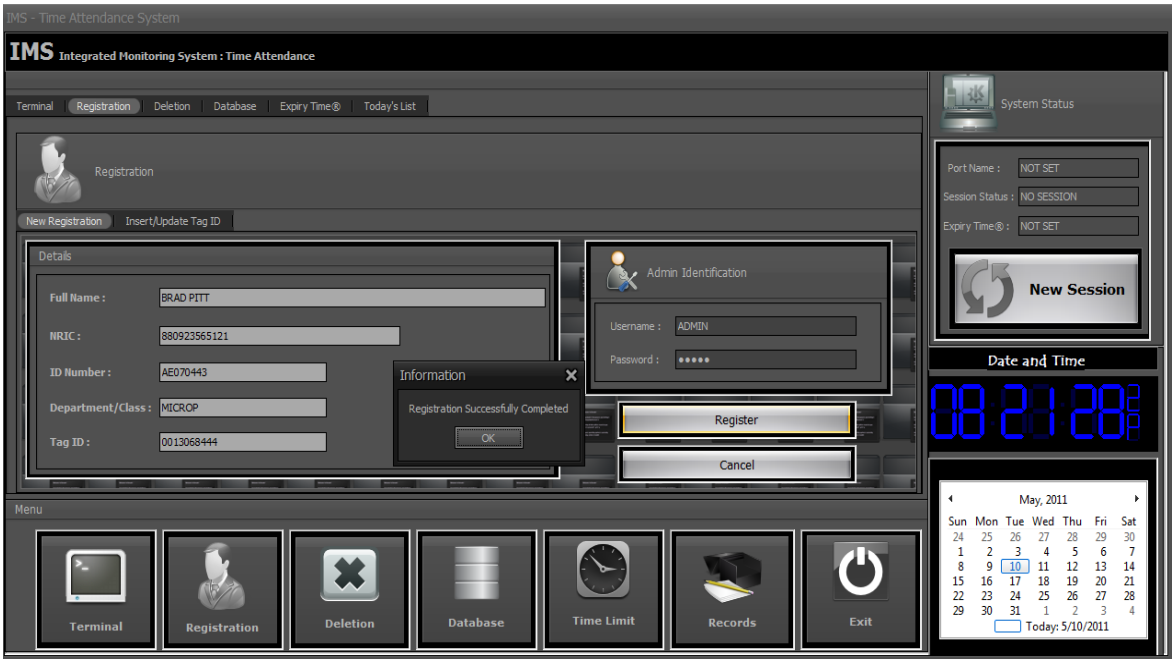

Figure 4.12: Registration form for new registration

Figure 4.13: Update tag ID

The registration form is divided into two sections which are new registration and insert or update tag ID. The purpose of new registration form is to register new ID with full detail required through the interface as shown in **Figure 4.12**.The details required are full name, NRIC, ID number, department or class, and tag ID. Only administrator has the access to register the ID. Besides that, each person cannot have more than one profile in the same department. The registration form for insert or update tag ID as shown in **Figure 4.13.** This option helps when direct registration is made. Direct registration means the details inserted directly into the database tables. All details can be inserted directly into the database table except for tag ID because it is stored in hexadecimal form. Thus it has to be converted into hexadecimal first. Because of that, this interface provides the ID conversion into hexadecimal before being stored in the database.

4.5.2 Deletion

Figure 4.14: Deletion Interface

Figure 4.14 shows the interface for delete profile ID. A profile ID can be deleted by inserting its full name or ID number. Only administrator has the access to delete profile as goes as registration. **Figure 4.15** shows the message generated when trying to delete a profile ID using a guest user account.

Figure 4.15: Deleting a Profile ID using Guest User Account

4.5.3 Database Interface

The Time Attendance also provides the interface to view the database as shown in **Figure 4.16**. Besides showing the personal details, it also shows the absent count out of total meetings of every profile ID. The database also can be viewed in list but in less detailed manner as shown in **Figure 4.17**. Refresh database function is required to effectively update the database after any data manipulation on the database has executed. The profile also can be searched throughout the database by entering the full name or ID number of the profile.

Figure 4.16: Database Interface

Figure 4.17: Database in List View

4.5.4 Time Limit Setting

Time Limit is developed to enable the system to set a time limitation of a session. The range of duration that can be set is between 5 to 30 minutes. The start time is the time port is opened and the end time is the time when the duration chosen has ended. Any tag scanned after the duration has ended is still considered as attended, but the status of the attendance is "LATE". Both administrator and guest user can set this time limit feature. The interface of time limit setting is shown in **Figure 4.18**

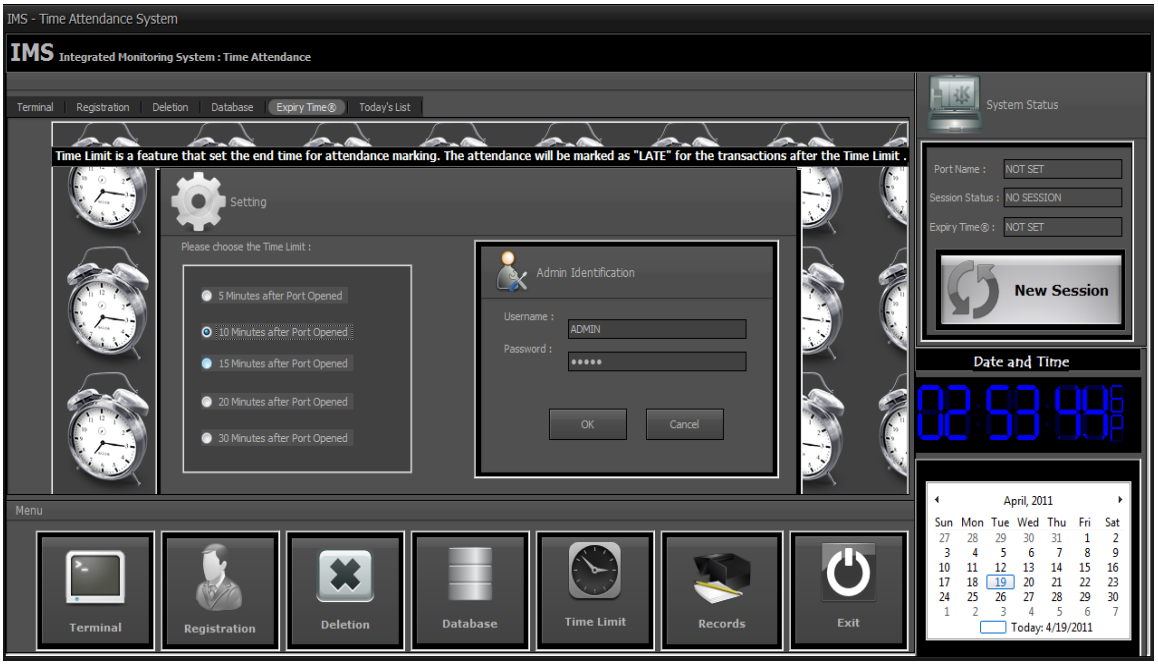

Figure 4.18: Interface of Time Limit setting

4.5.5 Records

After a session has ended, a record has been saved so it can be reviewed in future. The record is saved in PDF format file and the file name is based on the name given to the session during new session wizard. The file can be chose through the interface but will be opened by PDF file reader application such as Adobe Acrobat Reader as shown in **Figure 4.19** and **Figure 4.20**

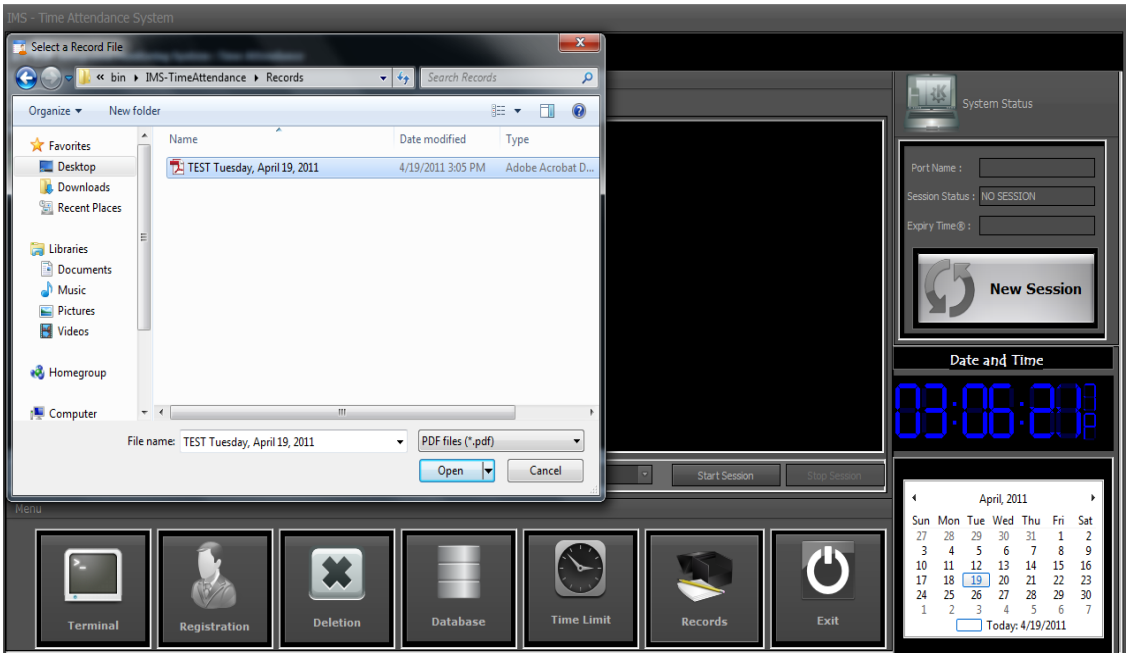

Figure 4.19: Choosing a record file through the interface

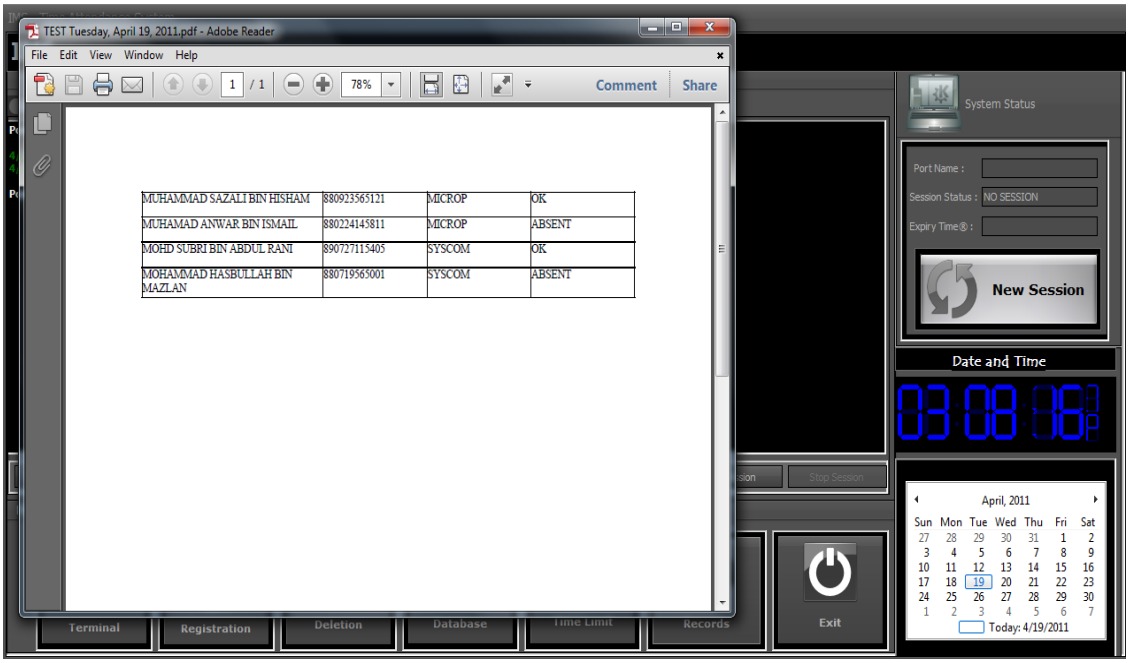

Figure 4.20: Opening the record file using PDF file reader

4.6 Attendance Marking Transaction

Every time the port is opened is treated as a session. Thus in order to open the port, a new session has to be created. Once the port is opened, the application can start reading any tag that has been scanned by the RFID reader.

4.6.1 New Session Wizard

New Session Wizard form will be called when a new session has to be created. In this wizard, the name of the session, the date of the session and the time of the session entered. This form also provides choices of department to be involved in that session. There are two choices of taking attendance which are by department and by whole company or class. The New Session Wizard form is shown in **Figure 4.21**

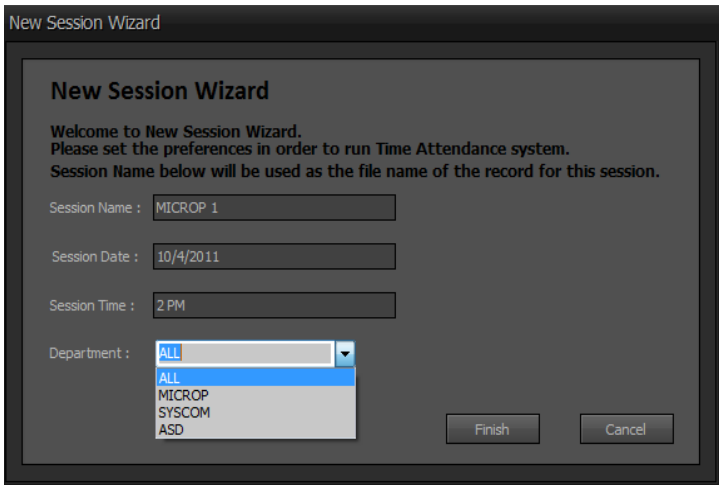

Figure 4.21: New Session Wizard form

4.6.2 Starting a Session

Once a new session has been configured in the New Session Wizard, the Start Session feature will be enabled. When a new session has been created, a temporary data is stored into temporary database. When the Start Session event is called, the program will refer to the temporary database to check whether a new session has been created or vice versa. If the temporary data is in that database, it will proceed to open the port for tag reading.

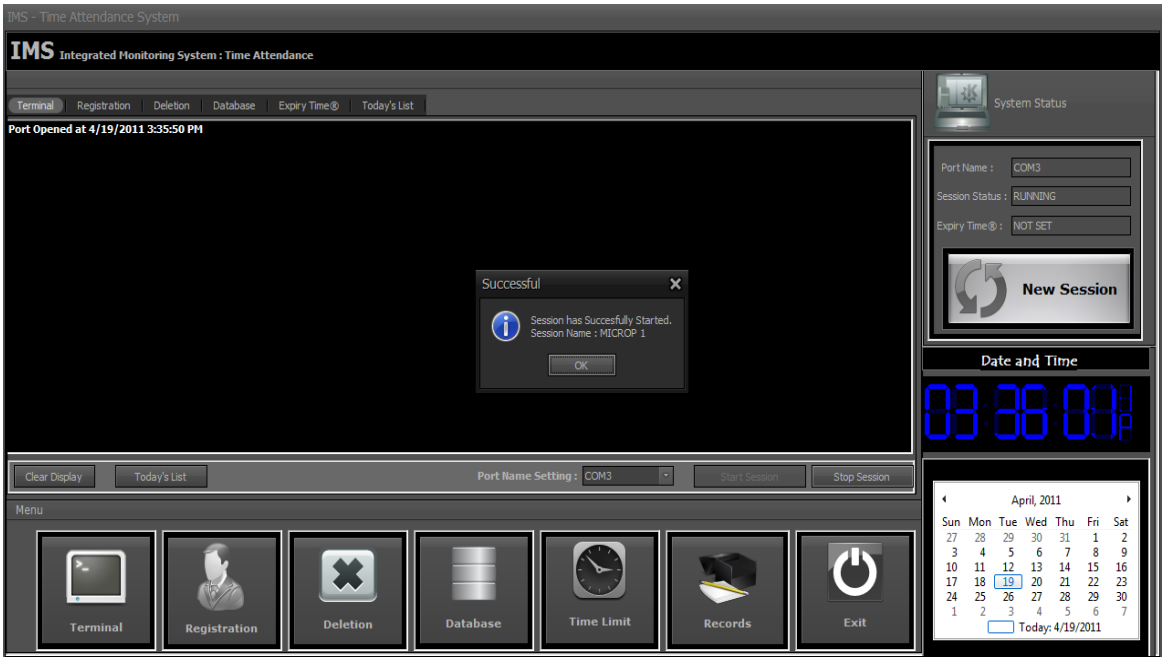

Figure 4.22: Start Session Event

4.6.3 Attendance Marking

When the tag scanned, the tag ID will be compared for a match in the database. Once the ID found, the full name and the ID number of the matched profile ID displayed in the terminal as shown in **Figure 4.23**. At the same time, the attendance will be updated from initially "PENDING" to "OK" or "LATE". The attendance table can be viewed in Today's List feature as shown in **Figure 4.24**.

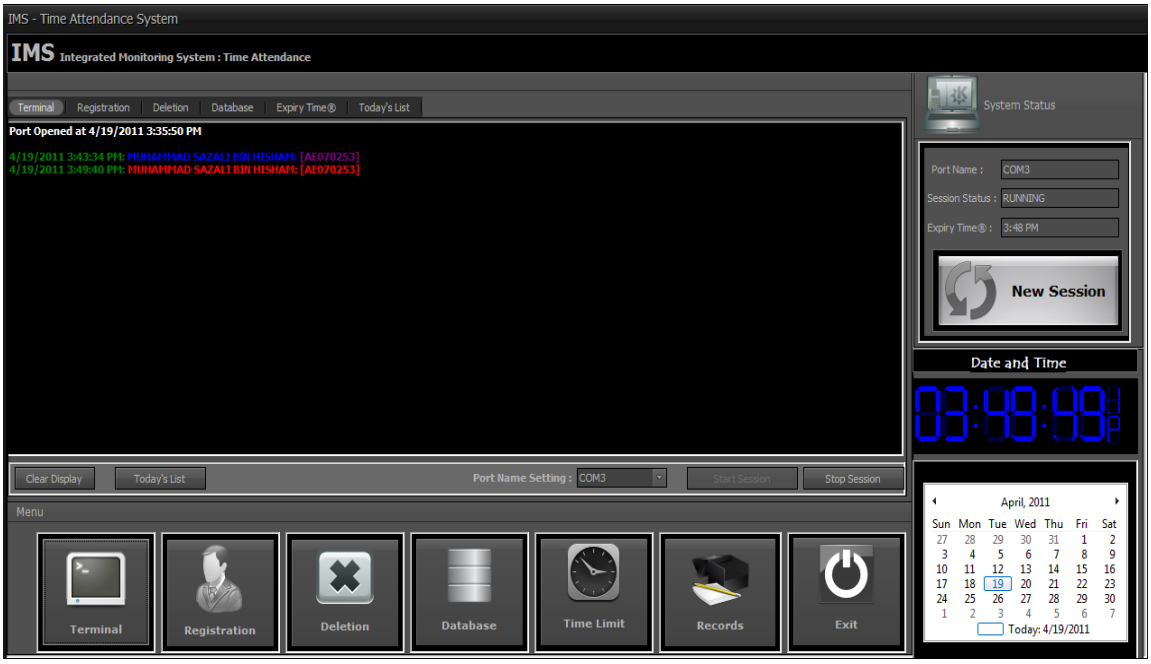

Figure 4.23: Transaction displayed on the terminal

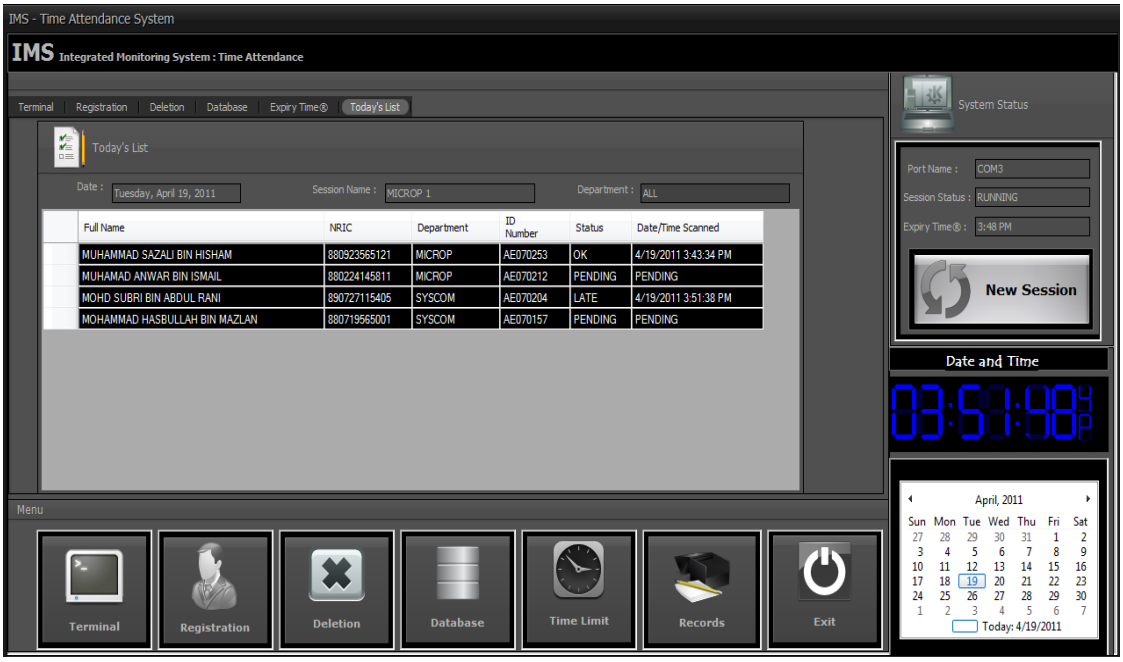

Figure 4.24: Today's List showing the attendance marking

4.6.4 Ending a Session

Ending a session means stopping from taking the attendance. Once the Stop Session event is called, the form that shows the summary of that session is called. Then record is written into PDF file and the temporary data in the database is cleared. Lastly, the port is closed. The session summary form is shown in **Figure 4.25**.

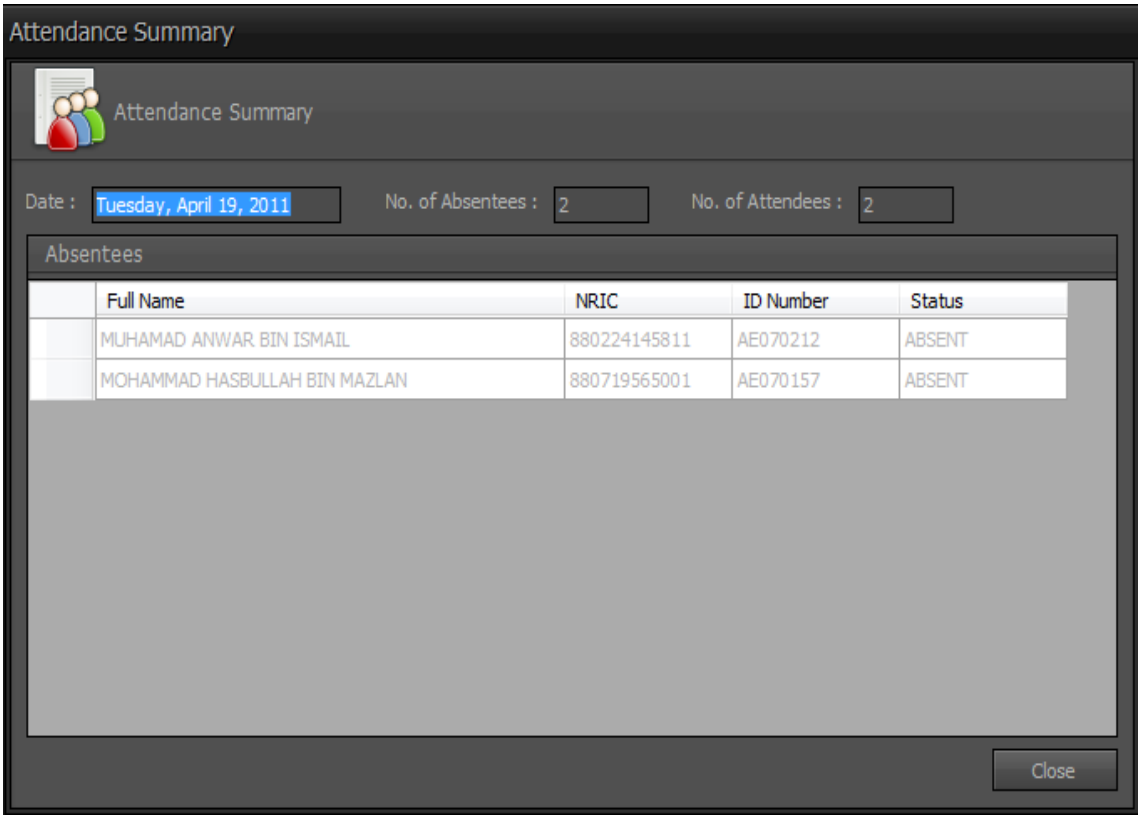

Figure 4.25: Attendance Summary

4.7 Remote Monitoring Client

The inputs required to connect to the host computer are server name, username and password. Server name is either the IP address of the host computer or the name of the host computer while the username and password are according to the host computer account setting. The interface of login form of the Remote Monitoring Client is shown in **Figure 4.26** and a successful connection is as in **Figure 4.27**

Figure 4.26: Remote Client Interface

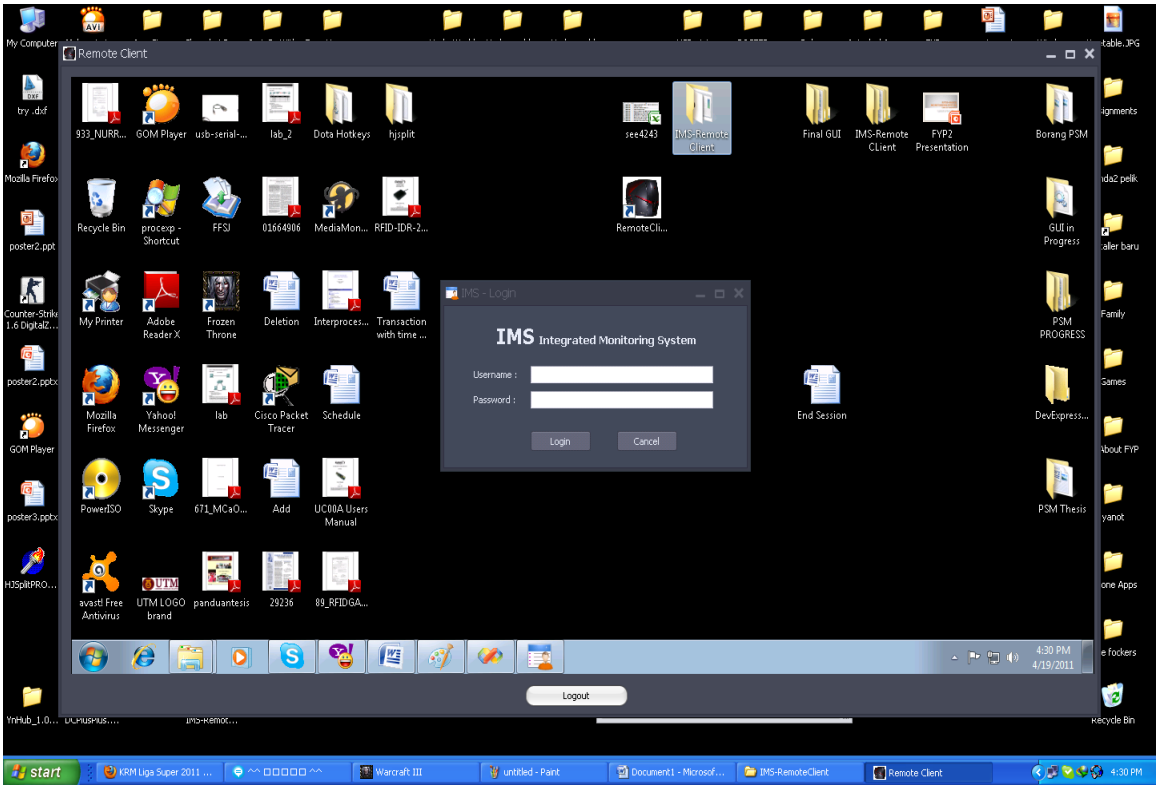

Figure 4.27: Successful connection to the host computer

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In conclusion, the objective to build an RFID based attendance system that can be monitored remotely has successfully achieved. In term of performance and efficiency, this project has provided a convenient method of attendance marking compared to the traditional method of attendance system. By using databases, the data is more organized. This system also is a user friendly system and easy to use as data manipulation and retrieval can be done via the interface. Besides that, all the data required are in general, making it a universal attendance system. Thus it can be implemented in an academic institution or in an office.

5.2 Recommendation

Some further improvements can be made on this project in order increases its reliability and effectiveness. There are two parts of improvements, which are hardware improvement and software improvement.

5.2.1 Hardware Improvement

The current RFID reader used in this project only support very short distance reading. By replacing this reader with a long range reader, it can increase the performance of the system as attendees just only need no walk pass by the reader without actually bringing the tag out. Other than that, a hardware user interface can be build by the usage of microcontroller, LCD and LED so the attendees can view the transaction. Furthermore, an IP camera can be integrated into this system to enable the monitor to view the person who making the transaction. As a result, this can avoid problem like a person scans in for other person.

5.2.2 Software Improvement

In software part, the database can be made with more detail approach thus every profile stored has full personal details. A reminder alert also can be developed to effectively track any ID that has been absent for an unacceptable times in a row. Besides that, this attendance system can be improved by adding a feature where it can save and recount the absent record if the absentee has absent under emergency leave or has the medical certificate as the proof of sickness.

The Remote Client Monitoring also can be improved by expanding the range of accessibility. Instead of connecting to the host computer through Local Area Network, the connection can be made between two different networks. Thus, it increases the mobility of this system.

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17. Window Form Custom Controls: *http://www.devexpress.com*

APPENDIX A

SOURCE CODE

Remote Monitoring Client

Form1 : Login Form

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Text;
using System.Windows.Forms;
using DevExpress.XtraEditors;
using MSTSCLib;

namespace RemoteClient{
public partial class Form1 : DevExpress.XtraEditors.XtraForm
{
 public Form1()
 {
    InitializeComponent();
 }
      private void simpleButton2_Click(object sender, EventArgs e)
{
   txtPassword.ResetText();
   txtServer.ResetText();
   txtUserName.ResetText();
   Application.Exit();
}
      private void simpleButton1_Click(object sender, EventArgs e)
{
   Form2 f2 = new Form2();
   try
   {
      f2.rdp.Server = txtServer.Text;
       f2.rdp.UserName = txtUserName.Text;
      IMsTscNonScriptable                    secured                    =
      (IMsTscNonScriptable)f2.rdp.GetOcx();
       secured.ClearTextPassword = txtPassword.Text;
       f2.rdp.Connect();
       f2.Show();
       this.Hide();
       this.ShowInTaskbar = false;
    }
    catch (Exception Ex)
    {
      MessageBox.Show("Error Connecting", "Error connecting to remote
      desktop  "  +  txtServer.Text  +  "  Error:    "  +  Ex.Message,
      MessageBoxButtons.OK, MessageBoxIcon.Error);
    }
    txtPassword.ResetText();
    txtServer.ResetText();
    txtUserName.ResetText();
 }}}
```

Form 2: Monitor Form

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Text;
using System.Windows.Forms;
using DevExpress.XtraEditors;

namespace RemoteClient
{
    public partial class Form2 : DevExpress.XtraEditors.XtraForm
    {
        public Form2()
        {
            InitializeComponent();
        }

        private void simpleButton1_Click(object sender, EventArgs e)
        {
            try
            {
                // Check if connected before disconnecting
                if (rdp.Connected.ToString() == "1")
                    rdp.Disconnect();
            }
            catch (Exception Ex)
            {
                Form1 frm1 = new Form1();
                MessageBox.Show("Error      Disconnecting",      "Error
disconnecting from remote desktop " + frm1.txtServer.Text + " Error:  "
+ Ex.Message, MessageBoxButtons.OK, MessageBoxIcon.Error);
            }
            Form1 f1 = new Form1();
            f1.Show();
            this.Close();
        }

    }
      }
```

Time Attendance

Form3 : Time Attendance Main GUI

Register

```
#region Registration
private void Register()
{
  string SQLString;
  SQLString                =                "INSERT                INTO
RegDB(Fnama,Icno,Org,Idno,Tagid,Datereg,Tagid2)VALUES('"              +
name.Replace("'", "''") + "','" + nric + "','" + org + "','" + idno +
"','" + "1" + ConvertToHex(tagid) + "2" + "','" + DateTime.Now + "','"
+ ConvertToHex(tagid) + "');";
 OleDbCommand SQLCommand = new OleDbCommand();
  SQLCommand.CommandText = SQLString;
 SQLCommand.Connection = database;
      int response = -1;
   try
   {
      response = SQLCommand.ExecuteNonQuery();
    }
   catch (Exception ex)
   {
       MessageBox.Show(ex.Message);
    }
  if (response >= 1)
  {
      int no = 0;
      string SQLString2;
       SQLString2              =              "INSERT              INTO
TodayAttDB(Fnama,Icno,Org,Idno,Tagid,Status,xTime,Meeting,Absent)VALUES
('" + name.Replace("'", "''") + "','" + nric + "','" + org + "','" +
idno + "','" + "1" + ConvertToHex(tagid) + "2" + "','" + "n/a" + "','"
+ "n/a" + "','" + no.ToString() + "','"+no.ToString()+"');";
            OleDbCommand SQLCommand2 = new OleDbCommand();
            SQLCommand2.CommandText = SQLString2;
            SQLCommand2.Connection = database;
      int response2 = -1;
       try
      {
        response2 = SQLCommand2.ExecuteNonQuery();
      }
      catch (Exception ex)
       {
         MessageBox.Show(ex.Message);
       }
       if (response2 >= 1)
       {
            DataRow[] row = ds2.Tables["DepDB"].Select("Dep='" + org +
            "'");
```

```
                int n = row.Length;
                 if (n > 0)
                {
                     XtraMessageBox.Show("Registration          Successfully
                     Completed", "Information");
                     LoadTADB();
                 }
                 else
                 {
                           string SQLString3;
                      SQLString3 = "INSERT INTO DepDB(Dep)VALUES('" + org +
                      "');";
                           OleDbCommand SQLCommand3 = new OleDbCommand();
                           SQLCommand3.CommandText = SQLString3;
                           SQLCommand3.Connection = database;
                      int response3 = -1;
                       try
                        {
                          response3 = SQLCommand3.ExecuteNonQuery();
                        }
                       catch (Exception ex)
                        {
                           MessageBox.Show(ex.Message);
                        }
                        if (response3 >= 1)
                        {

                           XtraMessageBox.Show("Registration  Successfully
                           Completed", "Information");
                           LoadTADB();
                        }
                  }
              }}}
#endregion
```

Delete

```
private void Deletename()
{
   name = tb_delname.Text;
   uname = tb_deluname.Text;
   pass = tb_delpass.Text;
   int re = 0;
   DataRow[] returnedrow;
   returnedrow = ds2.Tables["RegDB"].Select("Fnama='" + name + "'");
   re = returnedrow.Length;
         if (re > 0)
   {
      DataRow dr1;
      dr1 = returnedrow[0];
      XtraMessageBox.Show("Record       Found       :       "       +
      dr1["Fnama"].ToString(),"Record
      Found",MessageBoxButtons.OK,MessageBoxIcon.Information);
       DialogResult result;
      result    =    XtraMessageBox.Show("Delete    This    Profile?",
      "Confirmation", MessageBoxButtons.YesNo,MessageBoxIcon.Question);
       if (result == DialogResult.Yes)
       {
           int r = 0;
           DataRow[] row;
           row = ds1.Tables["PassDB"].Select("Unama='" + uname + "'");
           r = row.Length;
           int r2 = 0;
           DataRow[] row2;
           row2 = ds1.Tables["PassDB"].Select("Pass='" + pass + "'");
           r2 = row2.Length;
           if (r > 0)
           {
               DataRow drow;
               drow = row[0];
               DataRow drow2;
               drow2 = row2[0];
               if (drow == drow2)
               {
                    if (drow["Utype"].ToString() == "USER")
                    {

                        XtraMessageBox.Show("Access  denied."  +  "\n"  +
                        "You  do  not  have  the  Privillege  to  Delete  any
                        ID","Error",MessageBoxButtons.OK,MessageBoxIcon
                        .Error);
                    }
               }
               else
               {
                        string  queryDeleteString  =  "DELETE  FROM  RegDB
                        WHERE Fnama = '" + name + "'";
                         string   queryDeleteString2   =   "DELETE   FROM
                        TodayAttDB WHERE Fnama = '" + name + "'";
                        OleDbCommand sqlDelete = new OleDbCommand();
                        sqlDelete.CommandText = queryDeleteString;
```

```
sqlDelete.Connection = database;
 OleDbCommand sqlDelete2 = new OleDbCommand();
 sqlDelete2.CommandText = queryDeleteString2;
sqlDelete2.Connection = database;
int response = -1;
  int response2 = -1;
try
{
   response = sqlDelete.ExecuteNonQuery();
   response2 = sqlDelete2.ExecuteNonQuery();
}
  catch (Exception ex)
{
     XtraMessageBox.Show(ex.Message);
}
     if (response >= 1 && response2 >= 1)
{
XtraMessageBox.Show("Profile successfully deleted", "Successful",
MessageBoxButtons.OK, MessageBoxIcon.Information);
                                    }}}
else
{
XtraMessageBox.Show("Access denied." + "\n" + "Admin Identification not
Matched","Error",MessageBoxButtons.OK,MessageBoxIcon.Error);
}

}
else
{
XtraMessageBox.Show("Access denied." + "\n" + "Admin Identification not
Matched", "Error", MessageBoxButtons.OK, MessageBoxIcon.Error);
}}}
else
{
 XtraMessageBox.Show("Record Not Found",
"Error",MessageBoxButtons.OK,MessageBoxIcon.Error);
 }
  LoadTADB();
tb_deluname.ResetText();
tb_delpass.ResetText();
 tb_delname.ResetText();
tb_delid.ResetText();

 }
#endregion
```

Load Database

```
#region Load Database
       private void LoadPassDB()
       {
            string connectionString =
           "Provider=Microsoft.Jet.OLEDB.4.0;Data
           Source=Databases\\LoginDB.mdb;Jet OLEDB:Database Password=
           admin";
           database = new OleDbConnection(connectionString);
           database.Open();
           string sql = "SELECT * FROM PassDB";
           ds1 = new DataSet();
           da = new System.Data.OleDb.OleDbDataAdapter(sql, database);
           da.Fill(ds1, "PassDB");
           da1 = new System.Data.OleDb.OleDbDataAdapter("SELECT * FROM
           LogDB", database);
           da1.Fill(ds1, "LogDB");
       }

 private void LoadTADB()
       {
           string connectionString2 =
           "Provider=Microsoft.Jet.OLEDB.4.0;Data
           Source=Databases\\TADB.mdb;Jet OLEDB:Database Password=
           admin";
           database = new OleDbConnection(connectionString2);
           database.Open();
           da = new System.Data.OleDb.OleDbDataAdapter("SELECT * FROM
           RegDB", database);
           da1 = new System.Data.OleDb.OleDbDataAdapter("SELECT * FROM
           TodayAttDB", database);
           da2 = new System.Data.OleDb.OleDbDataAdapter("SELECT * FROM
           SessionDB", database);
           da3 = new System.Data.OleDb.OleDbDataAdapter("SELECT * FROM
           TempDB", database);
           da4 = new System.Data.OleDb.OleDbDataAdapter("SELECT * FROM
           DepDB", database);
           ds2 = new DataSet();
           da.Fill(ds2, "RegDB");
           da1.Fill(ds2, "TodayAttDB");
           da2.Fill(ds2, "SessionDB");
           da3.Fill(ds2, "TempDB");
           da4.Fill(ds2, "DepDB");
           MaxRows = ds2.Tables["RegDB"].Rows.Count;
           Rowcount();
       }
     #endregion
```

Display Data

```
      #region Display Data

       [STAThread]
        private void DisplayData(MessageType type, string msg)
        {
             _displayWindow.Invoke(new EventHandler(delegate
             {
                  _displayWindow.SelectedText = string.Empty;
                    _displayWindow.SelectionFont = new
                    Font(_displayWindow.SelectionFont, FontStyle.Bold);
                  _displayWindow.SelectionColor =
MessageColor[(int)type];
                  _displayWindow.AppendText(msg);
                  _displayWindow.ScrollToCaret();
             }));
        }

      #endregion
```

Data Received

```
#region DataReceived

void comPort_DataReceived(object sender, SerialDataReceivedEventArgs e)
{
          LoadTADB();
          switch (CurrentTransmissionType)
          {

                case TransmissionType.Text:
                int bytes = comPort.BytesToRead;
                byte[] comBuffer = new byte[bytes];
                comPort.Read(comBuffer, 0, bytes);
                 string msg = ByteToHex(comBuffer);
                int re = 0;
                DataRow[] returnedrow;
                  returnedrow = ds2.Tables["RegDB"].Select("Tagid='" +
                  msg + "'");
                  re = returnedrow.Length;
                  if (re > 0)
                 {
                    DataRow dr1;
                    dr1 = returnedrow[0];
                    DateTime start = DateTime.Now;
                    DateTime end = xtime;
                    if (tb_exptime.Text == "NOT SET")
                    {
                       DisplayData(MessageType.Time, DateTime.Now +  ":
");
                        DisplayData(MessageType.Normal,
                        dr1["Fnama"].ToString() + ": ");
```

```
DisplayData(MessageType.Idnum, "[" + dr1["Idno"].ToString() + "]" +
"\n");

string SQLUpdateString = "UPDATE TodayAttDB SET Status ='" + "OK" +
"',xTime = '" + DateTime.Now + "'WHERE Fnama='" +
dr1["Fnama"].ToString() + "' AND Status= '"+"PENDING"+"'" ;
OleDbCommand SQLCommand = new OleDbCommand();
SQLCommand.CommandText = SQLUpdateString;
SQLCommand.Connection = database;
 SQLCommand.ExecuteNonQuery();
LoadTADB();
string String = "SELECT
Num,Fnama,Icno,Org,Idno,Tagid,Status,xTime,Meeting,Absent FROM
TodayAttDB ";
loadDataGrid(String);
}
else
{
 if (DateTime.Compare(start, end) < 0)
 {
         DisplayData(MessageType.Time, DateTime.Now + ": ");
         DisplayData(MessageType.Normal,   dr1["Fnama"].ToString() + ":
");
DisplayData(MessageType.Idnum, "[" + dr1["Idno"].ToString() + "]" +
"\n");
string SQLUpdateString = "UPDATE TodayAttDB SET Status ='" + "OK" +
"',xTime = '" + DateTime.Now + "'WHERE Fnama='" +
dr1["Fnama"].ToString() + "' AND Status= '" + "PENDING" + "'";
OleDbCommand SQLCommand = new OleDbCommand();
SQLCommand.CommandText = SQLUpdateString;
 SQLCommand.Connection = database;
 SQLCommand.ExecuteNonQuery();
LoadTADB();
string String = "SELECT
Num,Fnama,Icno,Org,Idno,Tagid,Status,xTime,Meeting,Absent FROM
TodayAttDB ";
loadDataGrid(String);
}
else
{
     DisplayData(MessageType.Time, DateTime.Now + ": ");
DisplayData(MessageType.Late, dr1["Fnama"].ToString() + ": ");
DisplayData(MessageType.Late, "[" + dr1["Idno"].ToString() + "]" +
"\n");
string SQLUpdateString = "UPDATE TodayAttDB SET Status ='" + "LATE" +
"',xTime = '" + DateTime.Now + "'WHERE Fnama='" +
dr1["Fnama"].ToString() + "' AND Status= '" + "PENDING" + "'";
OleDbCommand SQLCommand = new OleDbCommand();
SQLCommand.CommandText = SQLUpdateString;
 SQLCommand.Connection = database;
 SQLCommand.ExecuteNonQuery();
 LoadTADB();
string String = "SELECT
Num,Fnama,Icno,Org,Idno,Tagid,Status,xTime,Meeting,Absent FROM
TodayAttDB ";
loadDataGrid(String);}}}
```

```
else
{
DisplayData(MessageType.Time, DateTime.Now + ": " + "\t");
DisplayData(MessageType.Late, "UNREGISTERED" + "\n");

}
break;

default:
string str1 = comPort.ReadExisting();
 DisplayData(MessageType.Normal, DateTime.Now + "\t" + str1);
 break;

}}
#endregion
```

Display Database

```
        private void Record()
        {
              int r = ds2.Tables["RegDB"].Rows.Count;
              if (r > 0)
              {
                  DataRow dr = ds2.Tables["RegDB"].Rows[inc];
                  tb_fname.Text = dr.ItemArray.GetValue(1).ToString();
                  tb_nric.Text = dr.ItemArray.GetValue(2).ToString();
                  tb_dep.Text = dr.ItemArray.GetValue(3).ToString();
                  tb_idno.Text = dr.ItemArray.GetValue(4).ToString();
                  string x = dr.ItemArray.GetValue(7).ToString();
                  tb_tagid.Text = HexString2Ascii(x);
                  tb_datereg.Text = dr.ItemArray.GetValue(6).ToString();
              }
              else
              {
                  tb_fname.ResetText();
                  tb_nric.ResetText();
                  tb_dep.ResetText();
                  tb_idno.ResetText();
                  tb_tagid.ResetText();
                  tb_datereg.ResetText();
                  tb_absent.ResetText();
              }
              int r2 = ds2.Tables["TodayAttDB"].Rows.Count;
              if (r2 > 0)
              {
                  DataRow dr2 = ds2.Tables["TodayAttDB"].Rows[inc];
                  tb_absent.Text = dr2.ItemArray.GetValue(9).ToString() +
                  " out of " + dr2.ItemArray.GetValue(8).ToString() + "
                  meeting(s)";
              }
          }
          #endregion
```

APPENDIX B

IDR-232N RFID READER MANUAL

Cytron Technologies

RFID READER
RFID-IDR-232N

USER'S MANUAL

V1.2

September 2010

1. INTRODUCTION AND OVERVIEW

RFID-IDR-232N is plug and use RFID reader. It has been designed with capabilities and features of:

- Low cost solution for reading passive RFID transponder tags.
- Industrial grade casing for better outlook and protection.
- Every reader has been tested before is being shipped.
- **9600 baud** RS232 serial interface (output only) to PC.
- Fully operation with **5VDC** power supply from USB port.
- Buzzer as sound indication of activity.
- Red and green color LED for visual indication of activity.
- Standard RS232 serial cable (female) ready to plug to desktop PC.
- USB as power source from desktop PC.
- 2cm reading range.
- 0.1s response time.
- 12 bytes of data received include start of heading, RFID ID and start of text.

RFID-IDR-232N is fully working RFID tags reader and can be applied in:

- Security system.
- Car parking.
- Office.
- Hypermarket for item pricing.
- Student projects

RFID-IDR-232N can be connected to PC or microcontroller as part of embedded system.

This document elaborates the method in using RFID-IDR-23

2. PACKING LIST

Please check the parts and components according to the packing list. If there are any parts missing, please contact us at sales@cytron.com.my immediately.

1. 1 x RFID-IDR-232N with:
    - Female RS232 cable with USB and RJ11

3. POWER SUPPLY

RFID-IDR-232N power source is from USB connection. There is no communication through USB connector, only 5V is taken from this connector. The communication line is RS232 cable (serial port with female DB9)

- **Connect the USB to the USB port of PC or laptop.**

After providing power to RFID-IDR-232N, the LED will light ON with the RED color and buzzer will beep.

4. USING RFID-IDR-232N

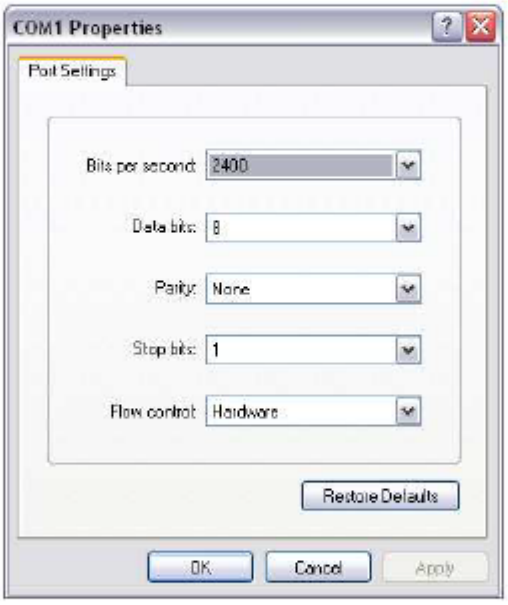
The hardware connection must be setup before RFID-IDR-232N can be used.

Connect RJ11 cable connector into RFID Reader as shown in figure.

The communication line has to be connected to serial port of PC.

After both power and communication line are connected, the HyperTerminal (software) need to be configured:

a. Open HyperTerminal
b. Choose COM1 (if you connect to COM1)
c. Configure the properties of COM1 to:
   i) Baud rate (Bits per second) = 9600
   ii) Data bits = 8
   iii) Parity = None
   iv) Stop bits = 1
   v) Flow control = None



Now, RFID-IDR-232N is ready to read address of a 125 KHz passive tag. Move the tag slowly towards RFID-IDR-232N (top), at approximately 2cm from the casing, the buzzer will sound, LED will turn to green when the tag move slowly towards RFID-IDR-232N and HyperTerminal will show the tag's ID in ASCII.

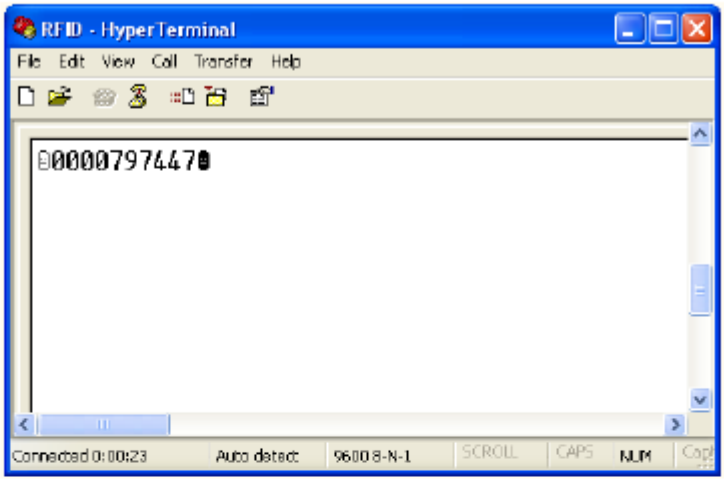


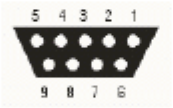
Figure above show the protocol of the RFID Reader. The extra byte of data at the first and the last of tag ID's. If the protocol users have is different from the protocol above, please contact us at sales@cytron.com.my immediately.

5. PIN CONFIGURATION

If RFID-IDR-232N is require on embedded system where no PC is available, hardware modification and interface is necessary. USB will provide 5V and ground to RFID-IDR-232N, while female DB9 is communication line to PC. Below show the pin configuration of USB, RJ11 and DB9 of RFID-IDR-232.

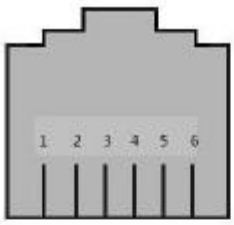
PIN No	Function
1	VCC
2	NA
3	NA
4	GND

USB female Connector



PIN No	Function
1	NA
2	Tx
3	Rx
4	NA
5	Gnd
6	NA
7	NA
8	NA
9	NA

Female DB9 pin Configuration



PIN No	Function
1	5V
2	NA
3	NA
4	Tx
5	Rx
6	Gnd

RJ11 female socket Configuration

RJ11 male pin Configuration

6. RFID-IDR-232N Protocol

High level language which can access to serial port can be used to develop program for RFID-IDR-232N on desktop PC or laptop. Some examples of high level language are Visual Basic, Labview and Visual C++.

If RFID-IDR-232N is connected to microcontroller, Assembly language or C compiler (depending on microcontroller type) can be used to write program.

RFID-IDR-232N will read the ID from RFID tag if the tag is near enough to RFID Reader. The ID is normally 10 digit of number. RFID-IDR-232N will automatically send this ID with 1 byte of Start of heading (0x01), followed by 10 byte of ASCII character (ID) and 1 byte of Start of text (0x02).

1 byte Start of Heading	10 byte RFID Identification	1 byte Start of Text

The 1st byte will be read is "Start of heading" followed with 10 bytes of RFID Identification number. The last 1 byte is "Start of Text"